MODERN PLASTICS

mp

OCTOBER 1944


Catalin
LIQUID RESINS
Their industrial importance lies in the good they do — not of themselves—but in combination with other materials!
Technically, the transformations performed by Catalin liquid resins are through the chemical joining processes of heat, or pressure, or their combination; the resins being infused into the treated materials. These steps take the form of impregnating, laminating, bonding, glueing or surface-finishing.
So versatile are these liquid resins that basically they still remain difficult to accurately classify—yet despite this elusive tendency much of the progress of the plastics industry is directly due to the great wealth of exploitation they have already fostered . . . And as great their PRESENT—still greater their FUTURE.
The Catalin research staff therefor welcomes an opportunity to discuss the many advantages afforded you by its family of plastics — which in addition to liquid resins includes molding compounds and cast resins. Inquiries invited.
CATALIN CORPORATION
ONE PARK AVENUE, NEW YORK 16, N. Y.
CAST PHENOLIC RESINS
Catalin
MOLDING COMPOUNDS

MODERN PLASTICS

AND PLASTICS

All editorial contents bearing on military subjects have been released for publication by the Armed Services.

MODERN PLASTICS is regularly indexed in the Industrial Arts Index.

Member Audit Bureau of Circulations

EXECUTIVE and EDITORIAL OFFICES: 122 E. 42nd St., New York 17, N. Y. WASHINGTON 6, D. C., OFFICE: 625 Colorado Bldg., 14th & G Sts. Published the 1st of each month by Modern Plastics, Incorporated. Publication Office, Twentieth and Northampton Sts., Easton, Pa. Subscription price $5.00 per year, $8.00 for 2 years in U. S., its possessions and South America. Canadian subscriptions $5.50 per year, $9.00 for 2 years; all other countries $6.00 per year, $10.00 for 2 years, payable in American money or its equivalent, Price 50¢ per copy. Printed in U. S. A. Entered as second class matter May 28, 1940, at the Post Office at Easton, Pa., under the act of March 3, 1879. Member of the Audit Bureau of Circulations. Back numbers 3 months or more preceding current issues, when available, $1.00 each.

VOLUME 22 OCTOBER 1944 NUMBER 2

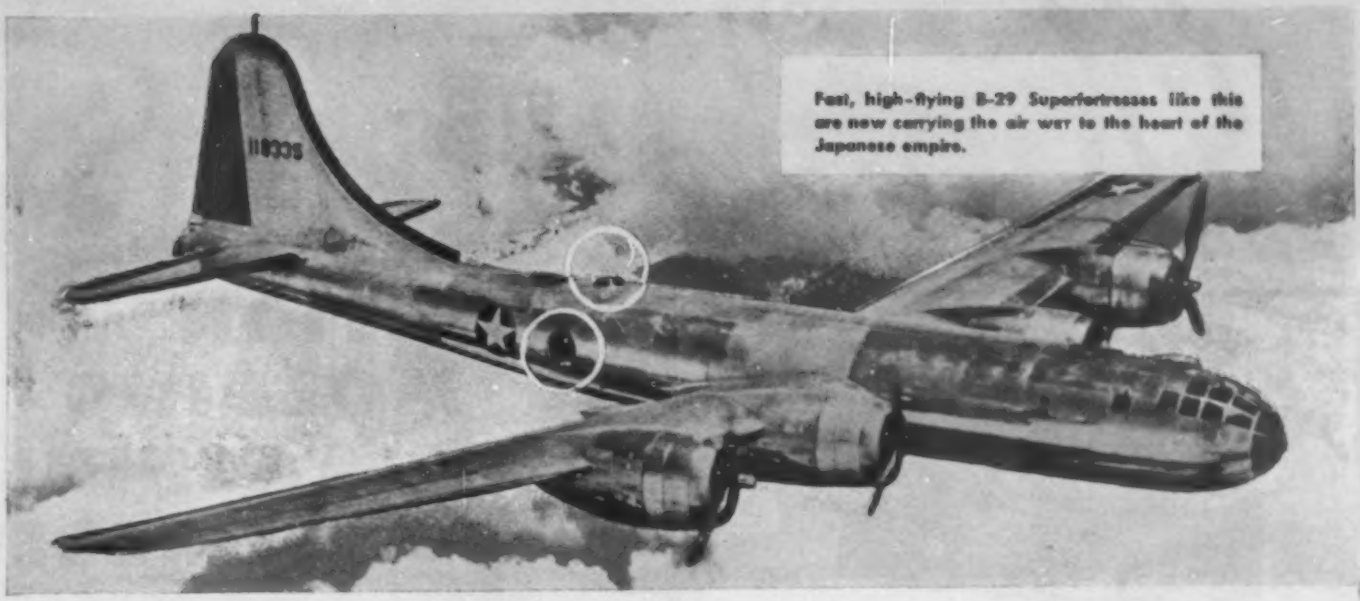
General Section

Plastics—Engineering Section

Technical Section

News and Features


This tobacco pouch may give you ideas!



Fast, high-flying B-29 Superfortresses like this are now carrying the air war to the heart of the Japanese empire.

Crew of new B-29 gain better protection during pressurized high altitude flying

WITH ENCLOSURES OF LAMINATED "LUCITE"-"BUTACITE"!

CREWS of the Boeing B-29 Superfortresses fly long distances at heights of 30,000 feet and in more comfort and warmth because of the superbomber's pressurized cabin.

Unprecedented in military planes, the pressurized cabin allows temperatures to be maintained at normal or near-normal—no matter how high the altitude.

Top and side turrets of Du Pont laminated "Lucite"-"Butacite" afford clear vision for the crew. Also the possibility of a major rupture by flak or bullets is eliminated, due to tendency of the interlayer of "Butacite" to seal a bullet hole or limit it to a small area even under pressure.

In the event of penetration, the hole is confined to the area of the actual point of impact, and it can be easily and quickly patched in flight with a prepared disc of "Butacite."

In addition to these advantages, the light weight and ease of forming and mounting make enclosures of laminated "Lucite" methyl methacrylate resin and "Butacite" polyvinyl butyral resin sheeting applicable to a wide variety of aircraft uses.

FULL FACTS: A new 28-page "Progress Report" on this laminate gives technical information on proof tests, property graphs, and application. For the designing, specification, forming or fabrication of transparent plane enclosures, address E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J., on your business letterhead for a free copy. Canadians write to Canadian Industries, Ltd., Box 10, Montreal.

• • •

A girl employee at the Boeing factory poses in one of the laminated "Lucite"-"Butacite" gunner's turrets in a B-29.

INVEST IN VICTORY—BUY WAR BONDS

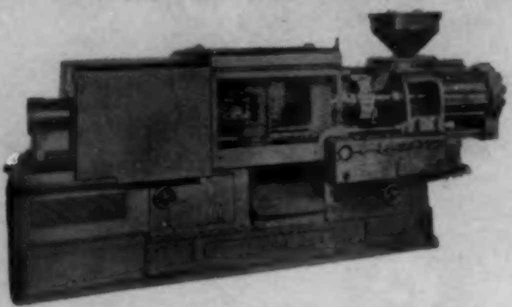
DU PONT

REG. U. S. PAT. OFF.

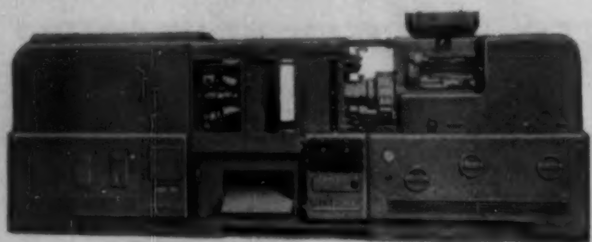
DU PONT PLASTICS

Better Things for Better Living ... *Through Chemistry*

Where REED-PRENTICE INJECTION MOLDING MACHINES are ASSEMBLED



REED-PRENTICE Injection Molding Machines 10 D-6 and 10 D-8 oz.—also 10 A-4 oz.



REED-PRENTICE Injection Molding Machines 10 F-16 and H-22 oz.

The facilities of this new and modern building are devoted to the assembly of Reed-Prentice Injection Molding Machines made possible by the wide acceptance and quantity production of these machines. Machine tool building skills, developed over 75 years, are well matched by the modern, high speed equipment in this assembly building.

Reed-Prentice's long and close relationship with every phase of plastics, culminates in a complete service for the injection molder, a service which includes design and manufacture of machines, and engineered, manufactured and tested molds.

INJECTION
REED-PRENTICE CORP.
WORCESTER MACHINES MASS., U.S.A.

NEW YORK OFFICE
75 West St.
New York 6, N. Y.
CLEVELAND OFFICE
1213 W. 3rd St.
Cleveland 13, Ohio

DOMESTIC: DETROIT — Kordenbrock Machinery Co. CHICAGO — Neff Kohlbusch & Bissell. SAN FRANCISCO — Osborne Machinery Co. LOS ANGELES — M Machinery Co. GRAND RAPIDS — Joseph Monahan. SYRACUSE — J. F. Owens Machinery Co. HOUSTON — Preston Machine Tool Sales. MINNEAPOLIS — Ch W. Stone Company. FOREIGN: CANADA, TORONTO, MONTREAL, WINDSOR — F. F. Barber Machinery Co. SOUTH AFRICA — National Engineering, Ltd., Jo nesburg. ENGLAND — Alfred Herbert, Ltd., Coventry. AUSTRALIA — Associated Machine Tools Australia, Sydney. INDIA — Alfred Herbert Ltd., Calcutta.

PHOTO - WESTERN ELECTRIC CO.

Life and Victory on the battlefront; increased production and improved quality on the homefront . . . all depend, in a large measure, on the *accuracy* of sensitive, scientific equipment. Protecting this accuracy enroute, is the important assignment entrusted to war-time packaging.

Among the multitude of packages manufactured by H & D, none had to be more painstakingly designed than the package to transport electronic tubes. The almost magic performance of these tubes is lost, if jarring falls or bumps disturb their high accuracy-quotient. So—for safe, undamaged arrival many of them make their journeys in H & D corrugated shipping boxes like those pictured above (licensed by Western Electric Company, Incorporated).

Today H & D is looking beyond the call of war-time duty. H & D Package Engineers are planning many packages for the peace-time pursuits of far-visioned customers . . . planning them with the great background of packaging knowledge accumulated in packaging for War. These men of the H & D Package Laboratories are ready *now* to help you prepare post-war packages that will protect and promote your products. Write for complete information.

KEEP ON BUYING MORE WAR BONDS

Tells HOW TO PREPAK with Corrugated Boxes

Greater safety in shipment; better store handling service; reduction in over-all packaging costs; factory-fresh, undamaged merchandise for customers . . . these are the aims of H & D Prepak. The complete story is available in "How to Prepak in Corrugated Boxes." Get your copy by writing The Hinde & Dauch Paper Company, Executive Offices, 4414 Decatur Street, Sandusky, Ohio.

• • •

FACTORIES in Baltimore • Boston • Buffalo Chicago • Cleveland • Detroit • Gloucester, N. J. Hoboken • Kansas City • Lenoir, N. C. • Montreal Richmond • St. Louis • Sandusky, Ohio • Toronto

For postwar packaging . . better see H&D **HINDE & DAUCH**

AUTHORITY ON PACKAGING . . . CORRUGATED SHIPPING BOXES

NOTES ON DESIGN AND ASSEMBLY OF PLAX POLYSTYRENE

DESIGN. Engineers have recently found it fairly simple to design around the limitations of polystyrene at service temperatures greater than 75°C or 167°F, above which temperature polystyrene's exceptional electrical characteristics lose constancy. For instance, instead of using a solid coil form, polystyrene slabs are cemented to the coil, thus giving a lighter unit with greater heat dissipation.

When used for low loss dielectric plates and insulating film, polystyrene is positioned away from heat sources and exposed to air circulation wherever possible. The use of polystyrene for stand-off insulators, cable heads and spacers, high-voltage bushings and shields offers little difficulty.

ASSEMBLY. Screws tapped into polystyrene should not be more than hand tight, so as to prevent deformation of the material to more than ¼ to ½ percent. If the screw must be held tight against vibration, a cement is usually used, though in some cases a cork or rubber washer will hold the screw tight.

When a flat panel is fastened in place, the holding channel or frame should be kept flat, to avoid bending the panel. A channel is preferred to bolting. If bolts are used, they must be placed to distribute the load equally, and all of them should be under the same tension. Using a cork or rubber washer makes it easy to obtain uniform tension. In general, all sources of stress concentration greater than 1200 p.s.i. should be avoided. This means eliminating direct clamping, riveting, or re-entrant angles.

Polystyrene strips may be welded together or around coils by heating to 230°F and pressing. Rod may be bent to any shape by pre-heating to 230°F and cooling in position. Any machining should be done before heating and bending.

Other PLAX POLYSTYRENE bulletins — entitled Fabricating, What to Tell Machinists, How to Use Coolants When Machining, and How to Cement — have been published in preceding months. They will be sent as you request them.

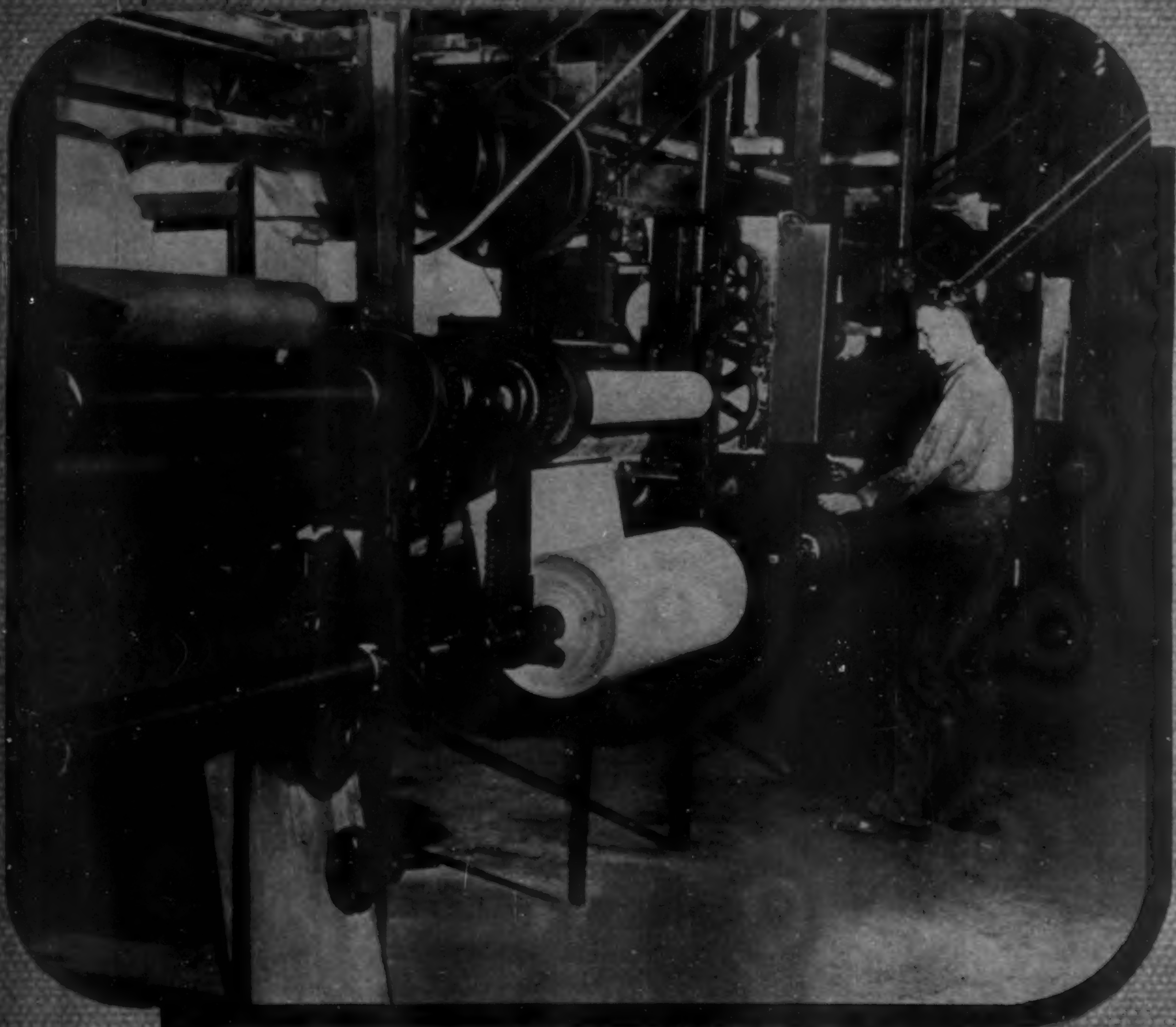
Plax supplies polystyrene in sheets, rods, tubes and in the famous Polyflex* Sheet and Polyflex Fiber — tough, flexible extruded forms with wide insulation possibilities.

Machined parts such as those shown above are produced by Plax to your exact specifications. Plax also supplies a polystyrene cement and anneals machined parts.

Write for bulletins which interest you, and for complete details of polystyrene's properties.

*Trade Mark Reg. U. S. Pat. Off.

PLAX
FOR PLASTICS
NOT SUBSTITUTES---IMPROVEMENTS
133 WALNUT STREET · HARTFORD 5 · CONN.



UNDER ONE BIG ROOF AT AUTO-LITE

BEAUTY *and* UTILITY

IN PLASTICS
IN METALS

ALL-PLASTIC PRODUCTS
Ornament for Ash Tray
Radiator Ornament
Instrument Panel • Crest

PLASTIC AND METAL PRODUCTS
Terminal • Custom Hardware
Horn Button • Radio Grill
Horn Button

ALL-METAL PRODUCTS
Molding Ornament • Horn Button
Name Plate • Scuff Plate
Grill • Cluster Dial

Not just plastics, not just metals, but both—and combinations of both—are the raw materials with which the Bay Manufacturing Division of Auto-Lite works to achieve true functional beauty. Beauty which works, as created by Auto-Lite under one big roof, will be one of the major forces in selling in tomorrow's competitive market. Postwar designers are invited to inquire into the advantages offered to them by Auto-Lite's artisanship in plastics and metals.

THE ELECTRIC AUTO-LITE COMPANY
Bay Manufacturing Division
DETROIT 2, MICHIGAN — BAY CITY, MICHIGAN

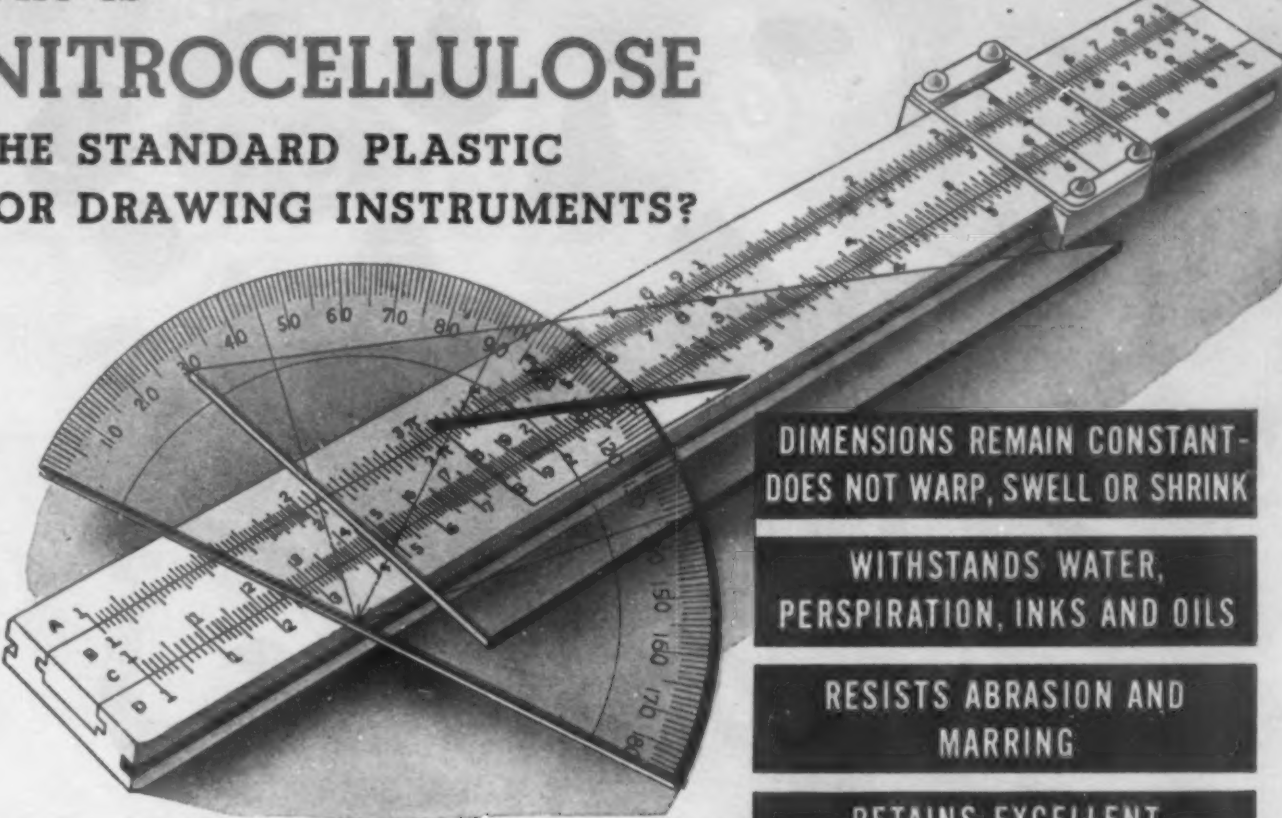
Tune in Auto-Lite's great radio show "EVERYTHING FOR THE BOYS" featuring men and women at the fighting fronts. Every Tuesday night — NBC Network

AUTO-LITE
PLASTICS AND METALS

WHY IS

NITROCELLULOSE

THE STANDARD PLASTIC FOR DRAWING INSTRUMENTS?



DIMENSIONS REMAIN CONSTANT-DOES NOT WARP, SWELL OR SHRINK

WITHSTANDS WATER, PERSPIRATION, INKS AND OILS

RESISTS ABRASION AND MARRING

RETAINS EXCELLENT TRANSPARENCY INDEFINITELY

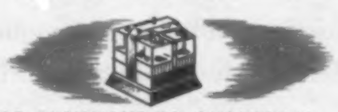
LOW IN COST

ALL THESE ADVANTAGES IN ONE LOW-COST PLASTIC

SO TOUGH
it is used to make billiard balls. (Toughest of all thermoplastics.)

SO BEAUTIFUL
in finish it is used to make luminous pearls.

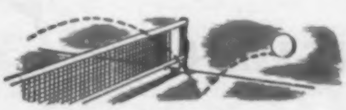
SO EASILY FABRICATED
by drilling, punching, sawing, turning, . . . can even be printed and polished.



SO RESISTANT TO CHEMICALS
it is used to make storage battery casings.

SO STABLE
dimensionally (will not warp, swell, shrink) is used for drawing instruments.

SO UNLIMITED IN COLOR
possibilities—pastels, vivid opaques, tinted transparencies, and pearl effects.



SO RESILIENT
it is the standard for ping-pong balls.

SO CLEAR
it is used for identification card windows.

SO LOW IN COST
it is used to make thousands of beautiful, inexpensive trinkets and novelties.

FREE check chart

Includes helpful information on the uses and technical characteristics of nitrocellulose plastics. Write today for your free copy.

HERCULES POWDER COMPANY
INCORPORATED
916 Market Street **Wilmington 99, Delaware**

CP—44

More Bearing Performance at Lower Cost . . . with

ROLLWAY RIGHT-ANGLE LOADING

Of course, you'll have to sweat out extra production after the war in order to . . .

1. **Hold your competitive position**
2. **Break into new markets**
3. **Cash in on the flood of postwar orders before the peak demand dries up**

So, right now, make sure that the new designs on your drafting boards are developing around these high-performance, heavy-duty bearings. Bearings that insure longer life at higher speeds, and under heavier loads.

For longer bearing life, more efficient performance and more economical maintenance . . .

FOLLOW THIS BASIC BEARING PRINCIPLE

- All radial loads carried at right angles to the roller axis.
- All thrust loads carried at right angles to the roller axis.

RIGHT ANGLE LOADING IS THE REASON

One look at the diagram tells you why Rollway's right-angle loading insures more performance per unit of cost. There are no compound loads to muddy up the stress analysis or to aggravate wear and cause premature failure. Loads are resolved into their simplest components of *pure radial* and *pure thrust*. And each of these separate components is carried by a separate roller assembly AT RIGHT ANGLES TO THE ROLLER AXIS. That means oblique resultants and compound forces are out.

There's no squeezing action to force the rollers from between the races, hence less end-rub and less roller-end wear back. Each separate assembly safely carries heavier loads at higher speeds, or gives proportionately longer life at the same load and speed.

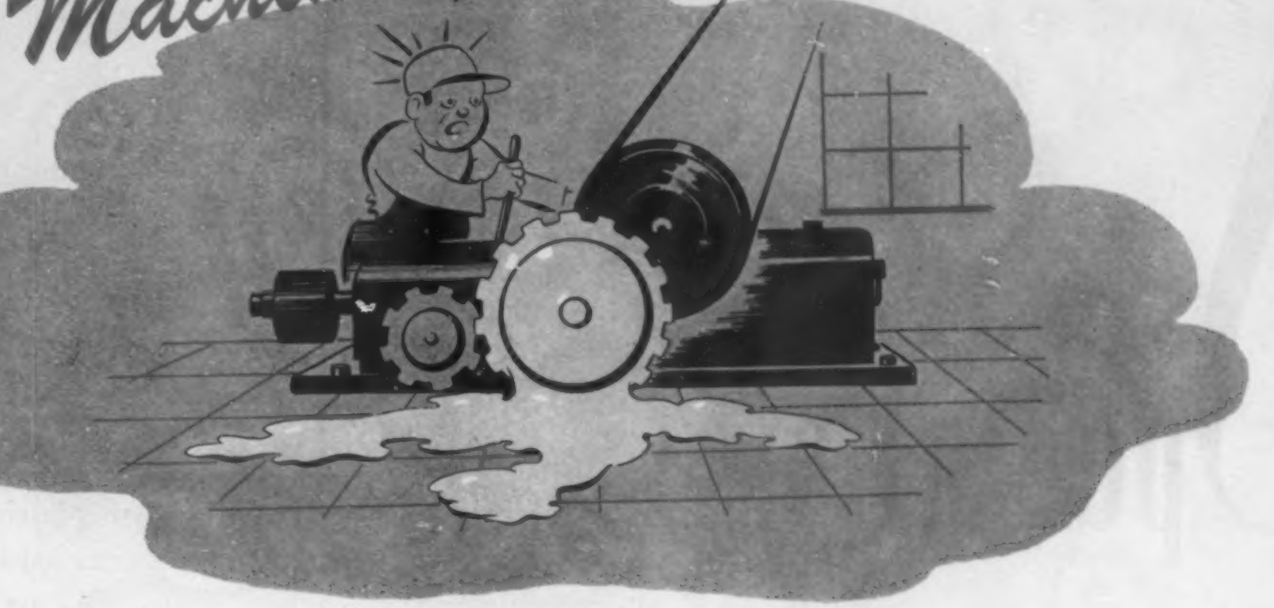
DON'T DELAY Send a sketch, drawing or detailed specification for free bearing analysis by Rollway engineers. The right type of bearing will make a vast difference in the ultimate performance and market for your product.

ROLLWAY BEARING COMPANY, INC., SYRACUSE, NEW YORK

BUILDING HEAVY-DUTY BEARINGS SINCE 1908 **BEARINGS**

SALES OFFICES: Philadelphia • Boston • Pittsburgh • Youngstown • Cleveland ○ Detroit • Chicago • St. Paul ○ Houston • Tulsa • Los Angeles

Machinery made of plastics?



We in the plastics industry know better. We know that metal will still be used to make machinery and to make a lot of other things that plastics can't make. But we also know that plastics have a really cooperative role to play in alliance with other materials.

For instance, we make a lot of plastic tubing. Some of it is flexible, some of it is rigid. It can be used in many applications where its insulation, chemical and weathering resistance and other qualities are important. It is being used in metal planes, with wooden structures, etc. And plastic tubing will have many more postwar applications.

MACOID has always been known as an innovator in plastics. Not only did we invent the modern method of extruding plastics, we have also consistently developed new items, new application for plastic extrusions under conditions of war and peace.

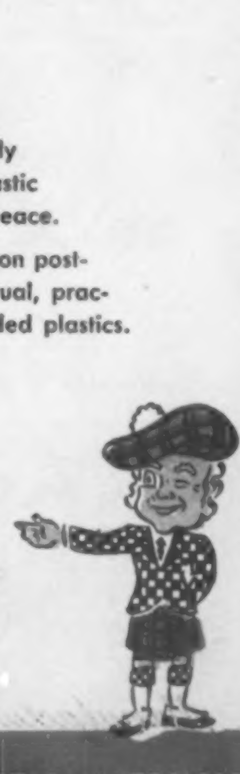
We are working with designers in all fields on postwar production. Not dream stuff, but actual, practical economical applications for extruded plastics.

We also do injection molding.

DETROIT MACOID CORPORATION

12340 Cloverdale Ave.
Detroit, Michigan

SOCIETY OF THE PLASTICS INDUSTRY · SPI ·



ORIGINATORS OF DRY PROCESS PLASTIC EXTRUSION

Tomorrow's Headlines in Plastics Come From Eclipse Today!

NOTE: A complete fabricating department is operating, producing completed assemblies. This too, may be an answer to some of your production problems.

IF YOU ARE THINKING OF PLASTIC PARTS LARGER THAN ANY PRESENTLY MANUFACTURED...

Consult Eclipse

In the past, many product parts were considered fantastic in plastic, solely because of their large size. This is no longer true. We, at Eclipse, did some dreaming and planning and installed new moulding equipment, capable of producing plastic parts larger than any presently manufactured.

Here, then, may be one answer to the plans of your Design Engineers, and to the leadership dreams of your Sales Manager. At any rate, it costs you nothing to find out. Our new equipment, new facilities, and experienced "know-how" are available for your planning, ready to work with you.

FACILITIES: *Compression, Injection, Extrusion, Fabrication, Combination Assembly, Design Assistance.*

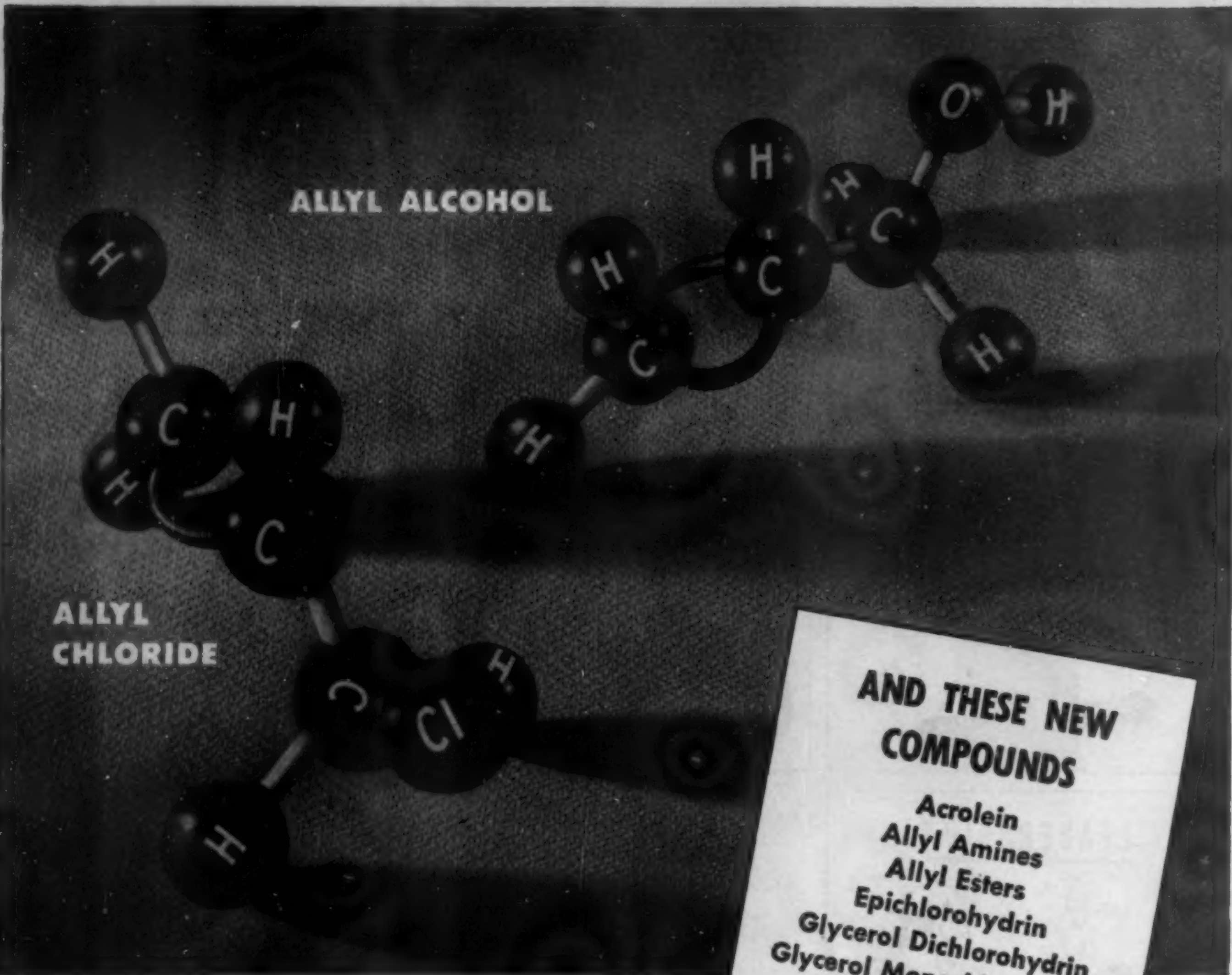
Eclipse Moulded Products

5158—North 32nd Street, Milwaukee 9, Wisconsin

CHICAGO • DETROIT • NEW YORK • CLEVELAND • KANSAS CITY

COMPRESSION • INJECTION • EXTRUSION MOULDING IN ALL PLASTIC MATERIALS

COMING...in Commercial Quantities



AND THESE NEW COMPOUNDS

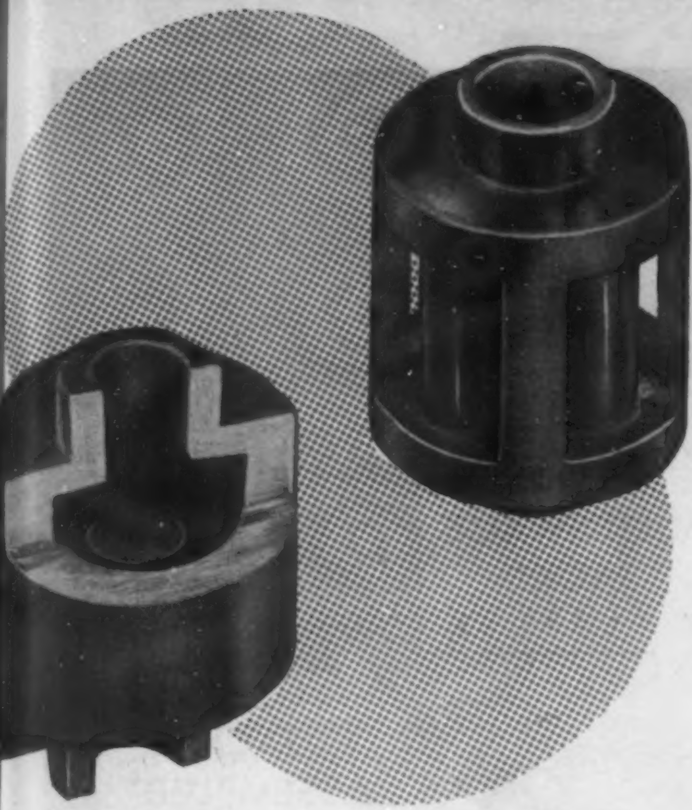
Acrolein
Allyl Amines
Allyl Esters
Epichlorohydrin
Glycerol Dichlorohydrin
Glycerol Monochlorohydrin
β Chlorallyl Alcohol
γ Chlorallyl Alcohol
Glyceryl Ethers
1·3 Dichloropropylene
1·2·3 Trichloropropane

Most of these compounds not available until after the war

THESE new chemicals . . . allyl alcohol, allyl chloride and diallyl ether . . . will be available in commercial quantities from a new Shell plant now under construction.

Chemists may look forward to the synthesis of many new compounds from these base materials. Your inquiries are invited.

SHELL CHEMICAL Division of SHELL UNION OIL CORPORATION
100 BUSH ST., SAN FRANCISCO 6, CALIFORNIA
R. W. GREEFF & CO., Eastern Sales Agent 10 ROCKEFELLER PLAZA, NEW YORK 20 TRIBUNE TOWER, CHICAGO 11



NUMBER 16 IN A SERIES OF EDUCATIONAL ADVERTISEMENTS ON TRANSFER MOLDING

ACCURATE

TRANSFER MOLDING offers sure accuracy in the handling of thermosetting plastic materials. This process, for the first time, made plastics a really precision industry.

The piece shown on the page illustrates almost perfect accuracy in every dimension. It is just one of thousands of items molded by the TRANSFER process for all industries. Even the high impact materials can be handled by TRANSFER MOLDING with great precision.

TRANSFER MOLDING *is the best way to*

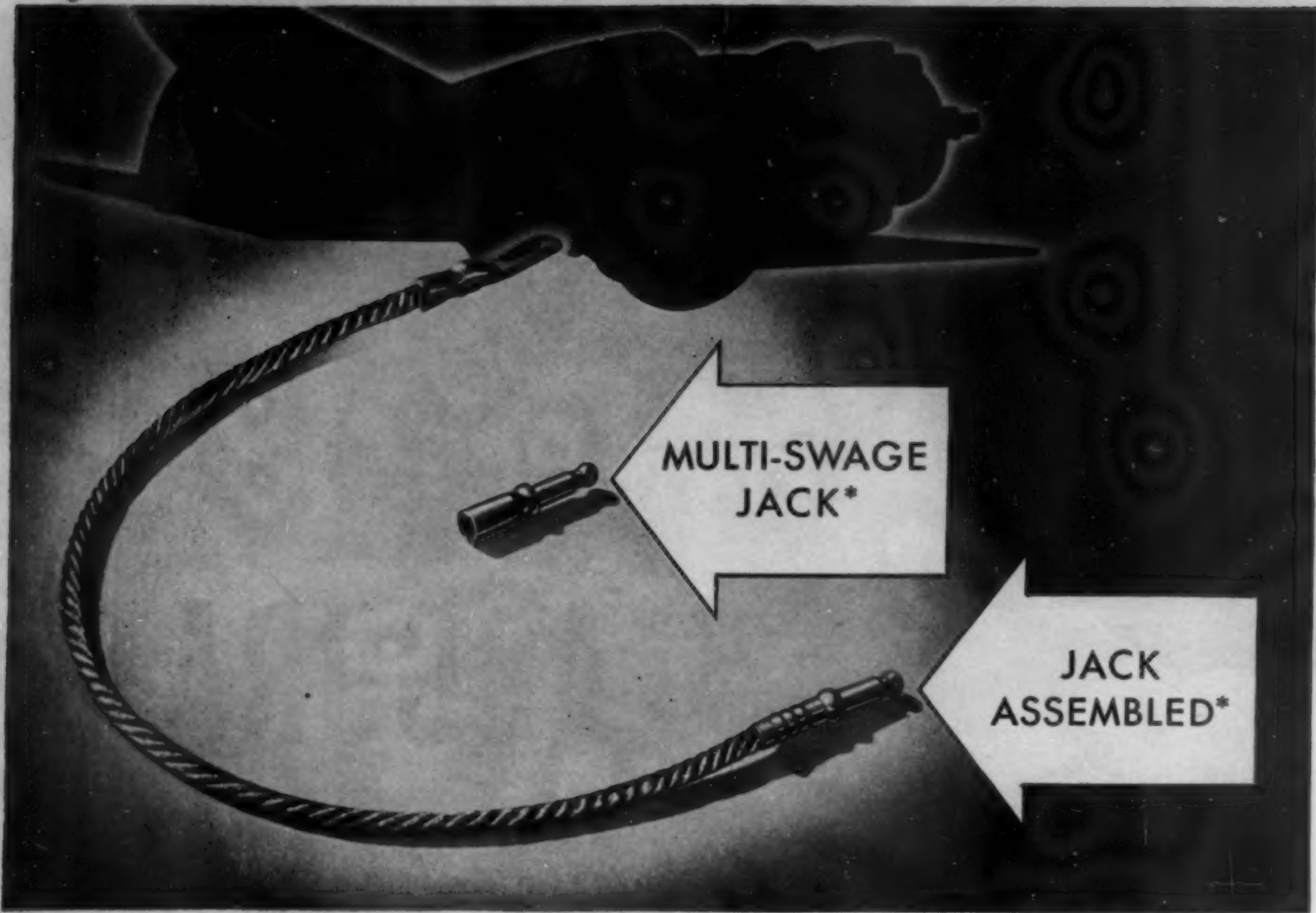
- Handle inserts—metal, glass, ceramic
- Mold high-impact materials
- Mold unsupported cores
- Achieve maximum dimensional accuracy
- Reduce trapped gases
- Lower mold costs
- Lengthen mold life
- Increase molding speed
- Reduce finishing costs
- Improve uniformity of cure regardless of cross-section
- Save material by eliminating flash
- Get practical solution to difficult molding problems

—on thermosetting plastics.

The extra demands of war for precision plastics have high-lighted the contribution of TRANSFER MOLDING—have accelerated the steady trend toward TRANSFER MOLDING in the plastics industry.

SHAW INSULATOR CO.

IRVINGTON SHAW NEW JERSEY



**Jack and complete disconnect bonding jumper designed and assembled by Aircraft-Marine Products, Inc.*

THE MOST ECONOMICAL METHOD

GOVERNMENT specifications require that every part of a military aircraft be electrically bonded. This precaution eliminates the hazard of fire that might result from electrical energy built up in one section of the plane being suddenly discharged to another, creating an arc.

Disposable gas tanks, engine cowls and other accessory parts are fitted with a length of high-conductivity cable. When the units are assembled the jack on the cable is plugged into a receptacle on the plane. These jacks are made by MULTI-SWAGE at a fraction of the cost of other methods.

The BEAD CHAIN MULTI-SWAGE PROCESS forms small metal parts from flat stock. No metal is cut away and there is no drilling, thus no waste. Parts can be produced in volume and at high speed by MULTI-SWAGE while holding tolerances accurately. Our Research and Development Division will gladly assist you. Write for further information.

These are typical "Multi-Swage" products. This process will turn out large volume speedily while maintaining close tolerances accurately.

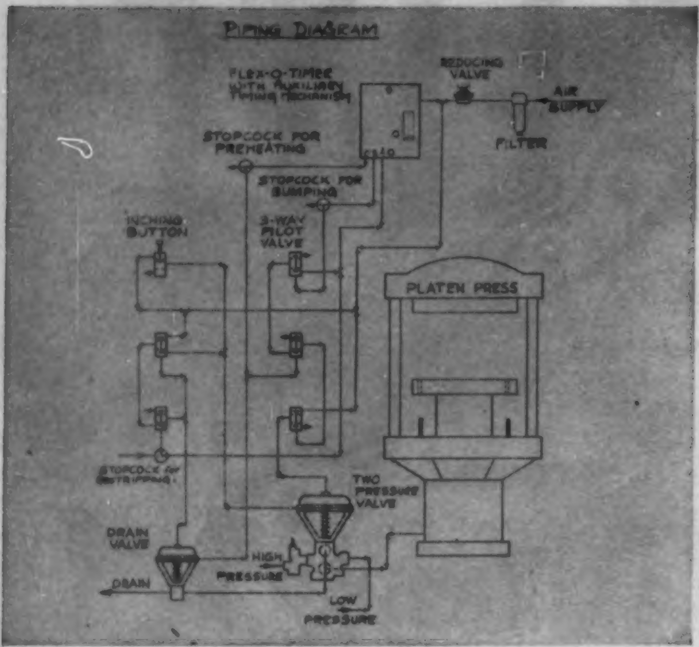
ARMY E NAVY

BEAD CHAIN **multi·swage** PROCESS

BACK THE ATTACK
BUY MORE WAR BONDS

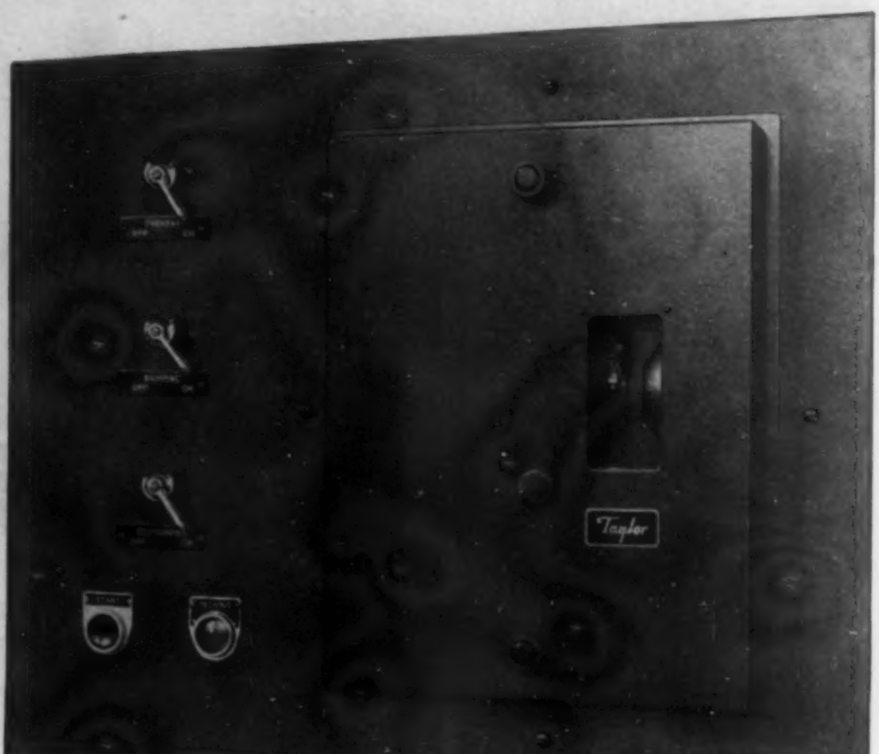
THE MOST ECONOMICAL METHOD OF PRODUCING SMALL METAL PARTS TO CLOSE TOLERANCES WITHOUT WASTE

THE BEAD CHAIN MANUFACTURING COMPANY
88 MOUNTAIN GROVE STREET, BRIDGEPORT 5, CONNECTICUT



DON'T LOOK

at this drawing for an idea of what Taylor Automatic Control can do for your plastics molding press. It looks like a month's work for your best engineers. But it isn't. It's all done. The whole Taylor Co-ordinated Control System comes to you *complete* in the compact panel shown below, ready for installation.



LOOK

how simple it is. All you do is set the Taylor Flex-O-Timer, push the button, and it does the rest! Here's what this set-up gives you:

- Fully automatic, accurate timing—reproduces cycles "on the button" every time.
- Small auxiliary timer within the Flex-O-Timer case times molding period only, without disturbing main settings on the Flex-O-Timer.
- Manual selection of Preheating, Bumping or Gassing, and Restripping.
- Handy "inching" button for clearing stripping pins for next load.

It's flexible enough for any material you want to use—with just a few simple adjustments of the Flex-O-Timer dial. It pays for itself in better production and fewer rejects. Call your Taylor Field Engineer. Or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow and liquid level.*

BUY ANOTHER WAR BOND TODAY!

ARMY E NAVY

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

Which is Better?

THE OLD WAY WITH 5 HAND OPERATIONS

OR THE SPEED NUT WAY WITH ONLY 3 OPERATIONS

And **a SPEED NUT is a self-locking nut, too, that weighs less, stops vibration loosening and cuts assembly costs 40-50% . . .**

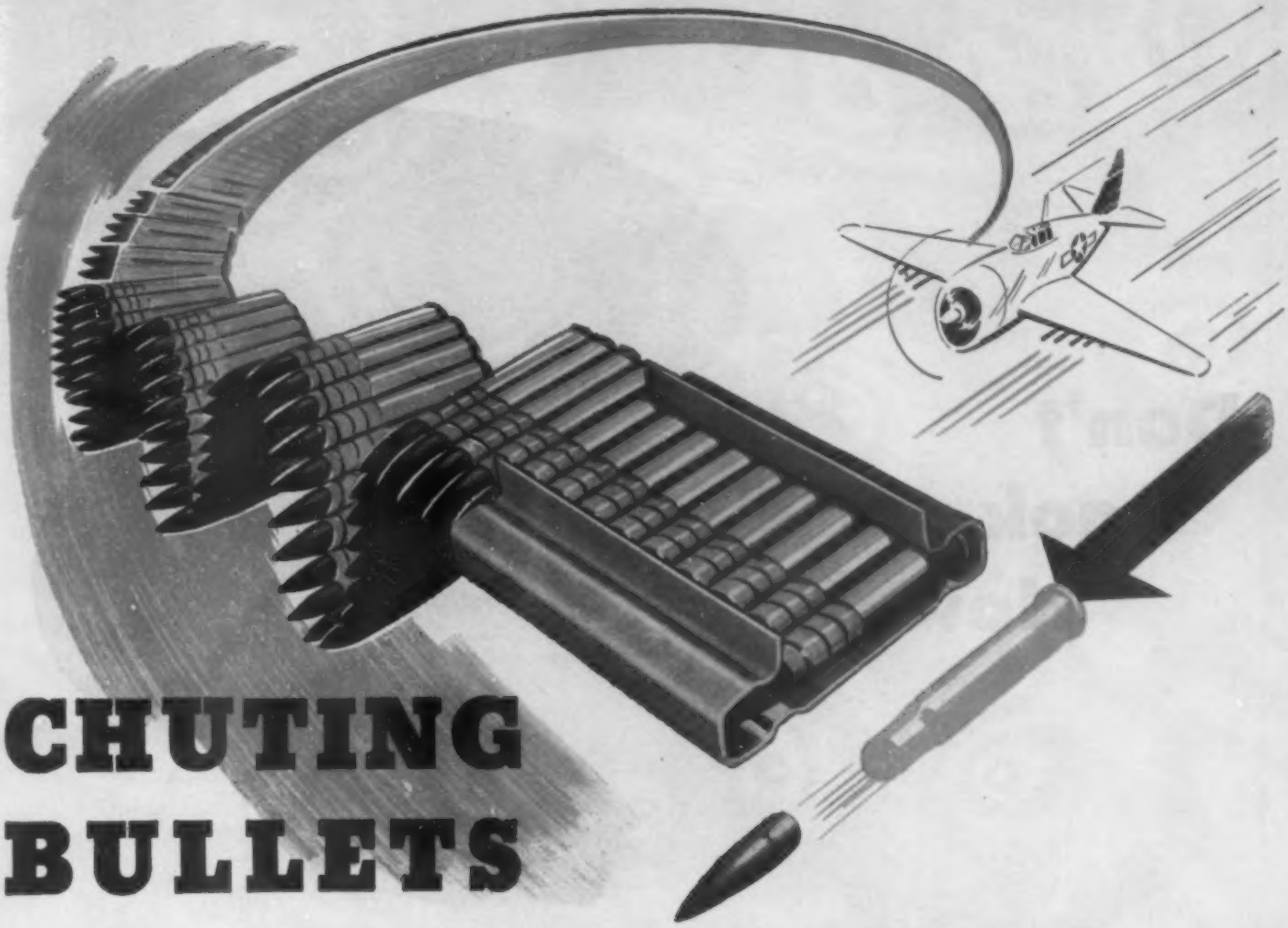
The SPEED NUT method requires only 3 hand operations as shown in photos above. And only 2 parts are needed instead of 3. Why go through 5 hand operations when only 3 are necessary? Why handle 3 parts when only 2 are required? For an eye opener on the economies of the SPEED NUT system just multiply this 40% motion-saving by the millions of fasteners you use per month. Then add to that the saving by eliminating 1/3 of the parts. Your figures will amaze you. The winning products in postwar competition will be those that are assembled faster and protected against loosening from vibration. Billions of SPEED NUTS were used before the war and on war products, too. More billions will be used on postwar products. Over 2,000 shapes and sizes. Engineers who move up faster are those who know how to make assembly lines move faster. Write for literature.

TINNERMAN PRODUCTS, INC.
2048 FULTON ROAD, CLEVELAND 13, OHIO
In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario
In England: Simmonds Aerocessories, Ltd., London

F A S T E S T   T H I N G S   I N   F A S T E N I N G S

*Speed Nuts**
[PATENTED]

*Trademark Reg. U. S. Patent Office



CHUTING BULLETS

into firing position with strong, lightweight

MICARTA

PUMP RINGS made of Micarta do not soften in service, wear slowly, and will not score cylinder walls.

ANTENNA MASTS of Micarta hold the antenna taut without yield or wobble . . . withstand wide extremes of pressure and temperature.

BOMB RACKS have been successfully molded of Micarta . . . furnish an excellent example of Micarta's strength and the skill of Westinghouse engineers in intricate molding assignments.

Westinghouse Micarta
THE INDUSTRIAL PLASTIC

Another example of versatile Micarta at work

Bullets for a plane's chattering wing-guns are stored in long, looping belts. To guide each bullet accurately into firing position, plane makers are now using chutes formed of *MICARTA—"444"*, the light, strong sheet plastic. Here's why:

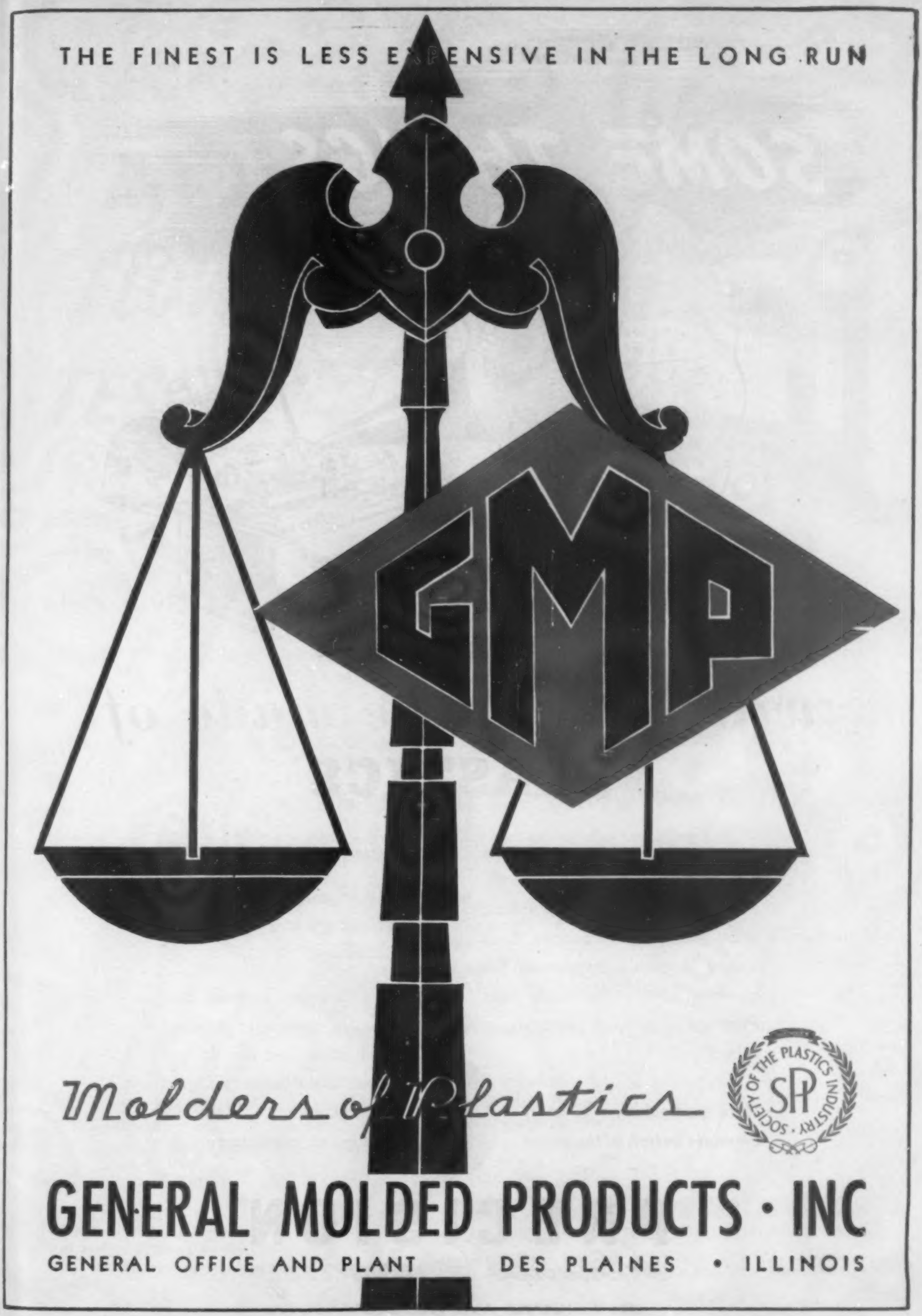
MICARTA weighs approximately one-half as much as aluminum of equal strength—helps eliminate superfluous weight in the plane.

MICARTA rates high in flexural, compressive and impact strength. In high altitude flying, as temperatures decrease, Micarta acquires added tensile strength.

MICARTA "444" is easily and quickly produced with inexpensive wooden molds. Sheets are subjected to heat and pressure, and formed into strong, intricate shapes.

This new, Micarta "444" is now accepted for use as trim tab fairing, accumulator covers, aviator's chart cases, fuselage tail-wheel housing, wing-gun ejection chutes. For further information and your copy of the new Micarta Data Book, B-3184-A, write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-06346-A


THE FINEST IS LESS EXPENSIVE IN THE LONG RUN
GMP
Molders of Plastics
SOCIETY OF THE PLASTICS INDUSTRY
SPI
GENERAL MOLDED PRODUCTS · INC
GENERAL OFFICE AND PLANT DES PLAINES • ILLINOIS

HOW FAST IS A MOLDING CYCLE?

That's something like asking, "How long is a piece of string?" Experienced molders know that many factors influence the speed of an injection molding machine in actual production, one of the most important of which is the rate of heating. Regardless of potential cycling speed, *no machine can make a molding any faster than it can plasticize the charge.*

Lester machines top all others in production speed for exactly this reason. The patented Lester injection cylinder plasticizes a given charge at 10% to 30% higher speed than that afforded by ordinary heating cylinders. This is accomplished by a ring-shaped heating chamber which applies heat simultaneously to both sides of a thin annular section of material, plasticizing it not only more quickly but more evenly and thoroughly as well.

As a case in point, one Lester user* reports that two 12-ounce Lesters in his plant are producing 30% faster than his other machines of similar rating. Needless to say, he plans to buy Lesters exclusively from now on.

Lesters make *better* moldings, too. Would you like to have additional data to prove this statement? Just drop us a line.

It will pay you to learn more about injection mold design. Write for your free copy of Islyn Thomas' articles on this subject, reprinted from Modern Plastics.

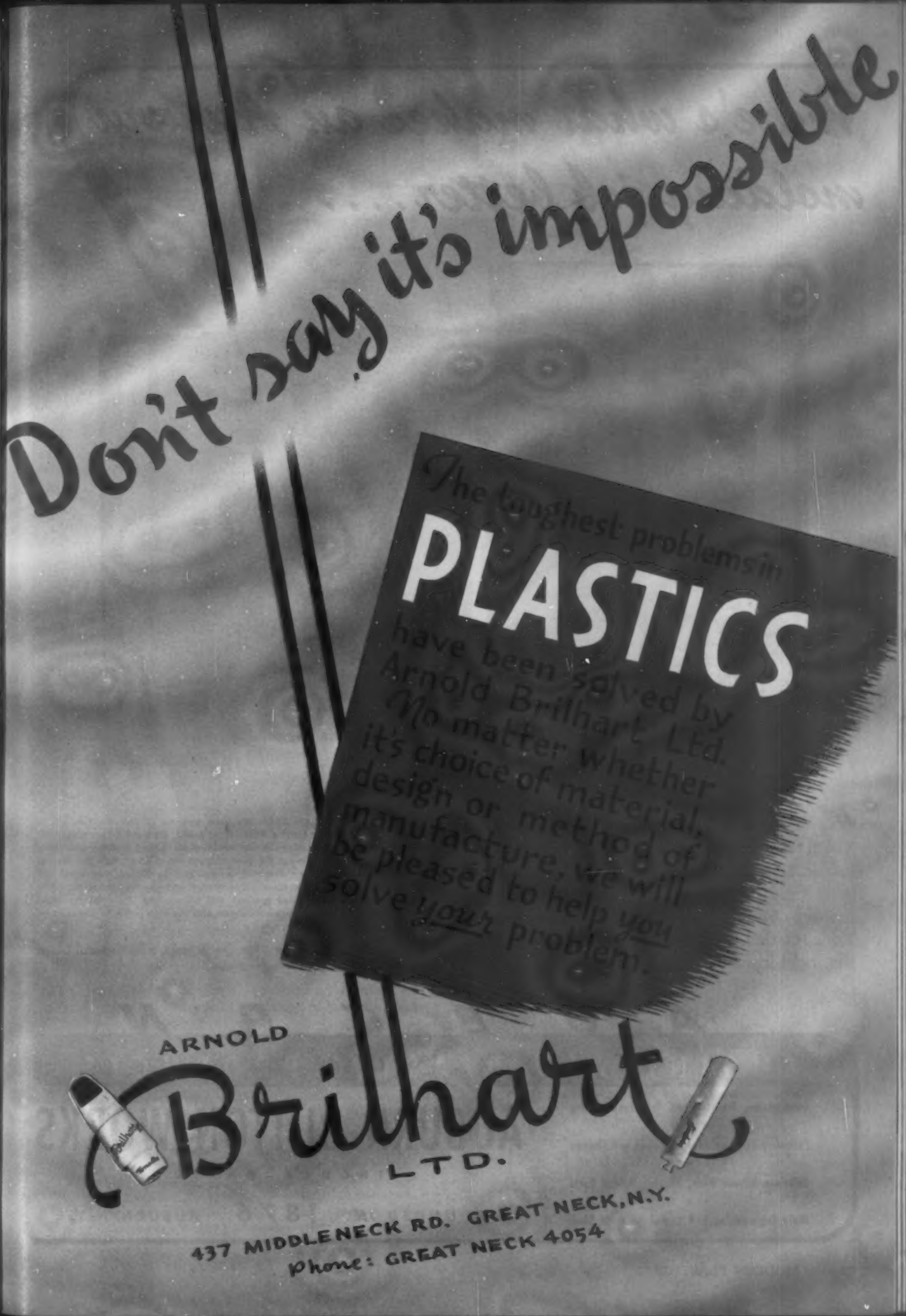
*Name on request.

LESTER

SHAPING THE THINGS OF TOMORROW

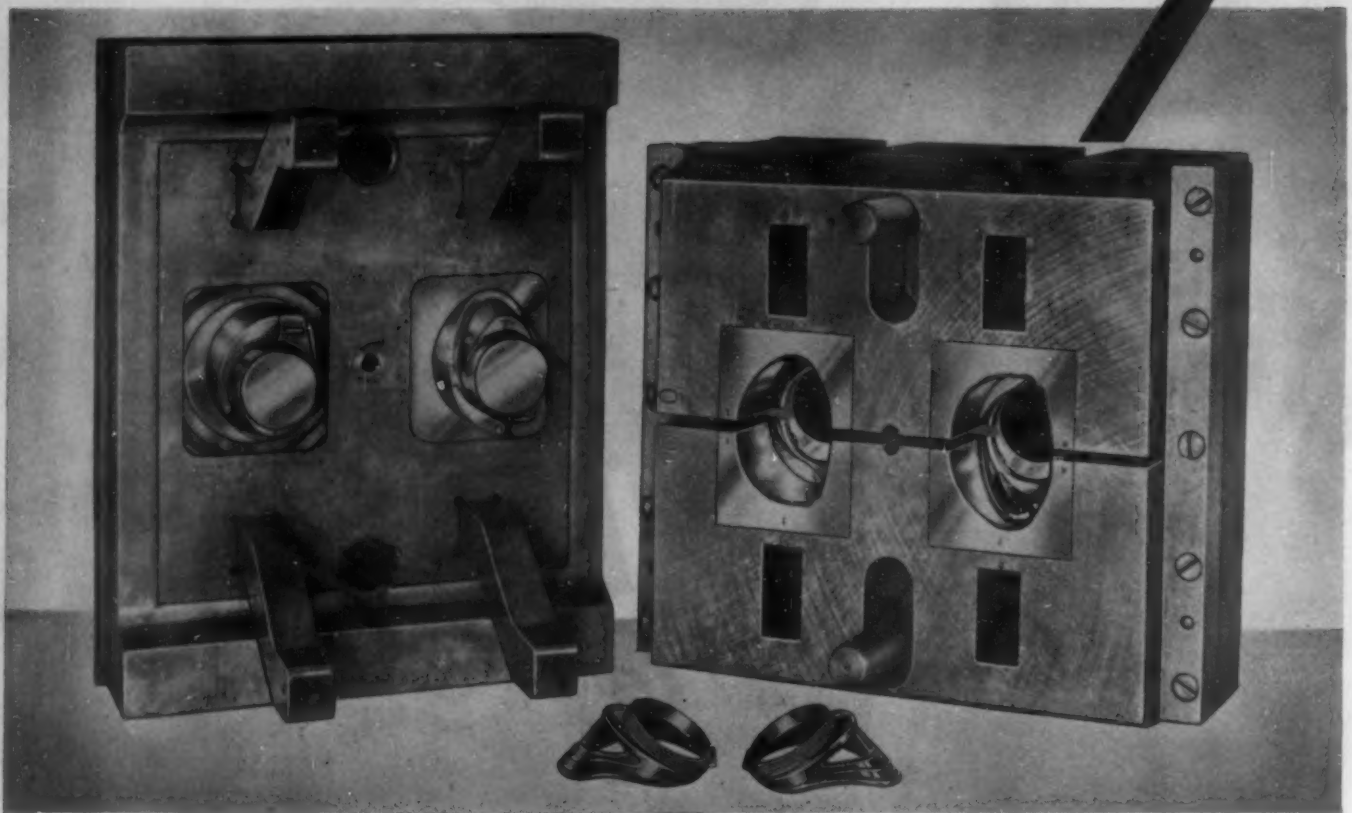
INJECTION
Molding Machines

National Distributors: **LESTER-PHOENIX, INC.**
2711 CHURCH AVENUE • CLEVELAND 13, OHIO



Don't say it's impossible
The toughest problems in
PLASTICS
have been solved by Arnold Brilhart Ltd. No matter whether it's choice of material, design or method of manufacture, we will be pleased to help you solve your problem.
ARNOLD
Brilhart
LTD.
437 MIDDLENECK RD. GREAT NECK, N.Y.
Phone: GREAT NECK 4054

Here's what makes an Auburn molding job better....



*M*old making facilities are the yardstick by which to measure your molder . . . for engineering skill, the finest molding equipment and the most rigid inspections are valueless unless the job gets off to a good start in a good mold. Your molded plastic parts can't be better than the mold in which they are formed.

Shown in the photograph above are both sections of the mold in which Bausch & Lomb Safety Goggle Frames are made. Because a thermo-plastic material was suitable for this use, the injection method of molding was used, lowering costs and increasing the rate of production. Although the frames are threaded, note that the shape of the guides is such that they open and close the split female die as the mold is opened and closed, permitting automatic ejection of the molded product and eliminating the need for hand unthreading. Note also the intricate detail and the high polish of the interior of this mold.

On your next molded plastic job, get in touch with Auburn. Learn how Auburn's *complete* service can help you.

AUBURN

ENGINEERED PLASTIC PRODUCTS

Compression, Transfer, and Injection Molding

* * *

Extruded Vinyl or Acetate Tubes and Shapes

* * *

Cellulose Nitrate Rods, Sheets, Molded Parts

* * *

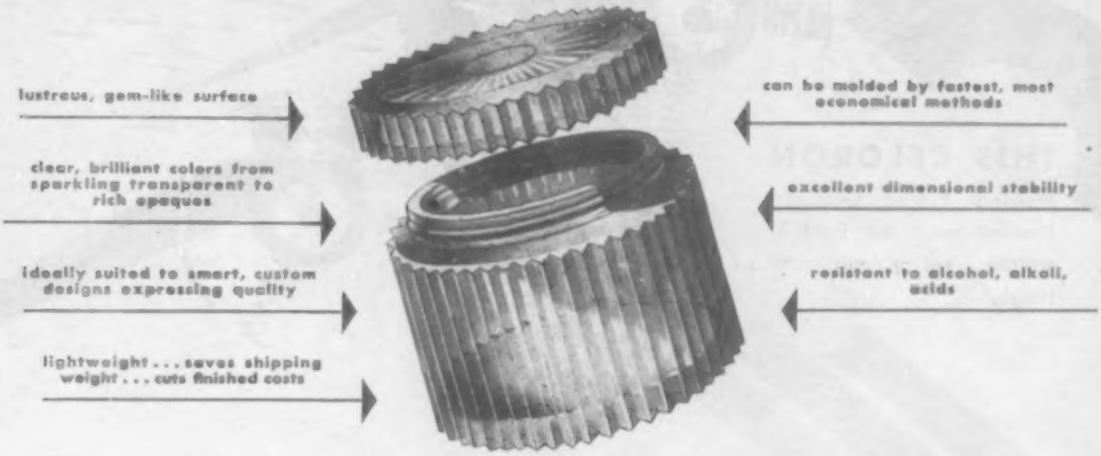
Mold Engineering and Complete Mold Shop

AUBURN BUTTON WORKS

INCORPORATED

FOUNDED IN 1876 AUBURN, N. Y.

LUSTRON



. . . for luxury appeal at bargain basement costs!

Postwar product planners — if you want to get the look and feel of quality in your products, yet keep them priced for mass selling, you'll want to know more about Lustron!

Molders — if you want steady volume in your postwar production, you'll find Lustron one of your most important sales tools!

☆ ☆ ☆

With their sleek, clean lines and clear, lustrous finish, products and parts of Lustron look and feel like quality.

They range in color from clear, sparkling, transparent, through delicate pastels to deep, rich opaques.

They are odorless, tasteless and are unaffected by alcohol, alkali and all but strong, oxidizing acids.

Thanks to their exceptional dimensional stability, they can be designed to close tolerances that would be impossible with any other plastic.

☆ ☆ ☆

Those are advantages well worth a premium . . . *yet Lustron molding compounds cost less per pound than any other type of thermoplastic.*

Since they also weigh less than any other rigid plastic, they also produce more finished products or parts per pound.

Finally, they can be injection molded, the fastest, most fully automatic and most economical of present molding methods.

☆ ☆ ☆

Obviously you will be seeing a lot of Lustron in postwar products . . . and you will be hearing a lot about Lustron in postwar markets. If you want to start now on plans to boost your postwar sales with Lustron, write: Monsanto Chemical Company, Plastics Division, Springfield 2, Massachusetts.

The broad and versatile Family of Monsanto Plastics includes: Lustron polystyrenes • Cerex heat resistant thermoplastics Vynate vinyl acetals • Nitron cellulose nitrate • Fibestos cellulose acetate • Resinox phenolics • Resimene melamines. Forms in which they are supplied include: Sheets • Rods Tubes • Molding Compounds • Industrial Resins • Coating Compounds • Vuepak rigid, transparent packaging materials.

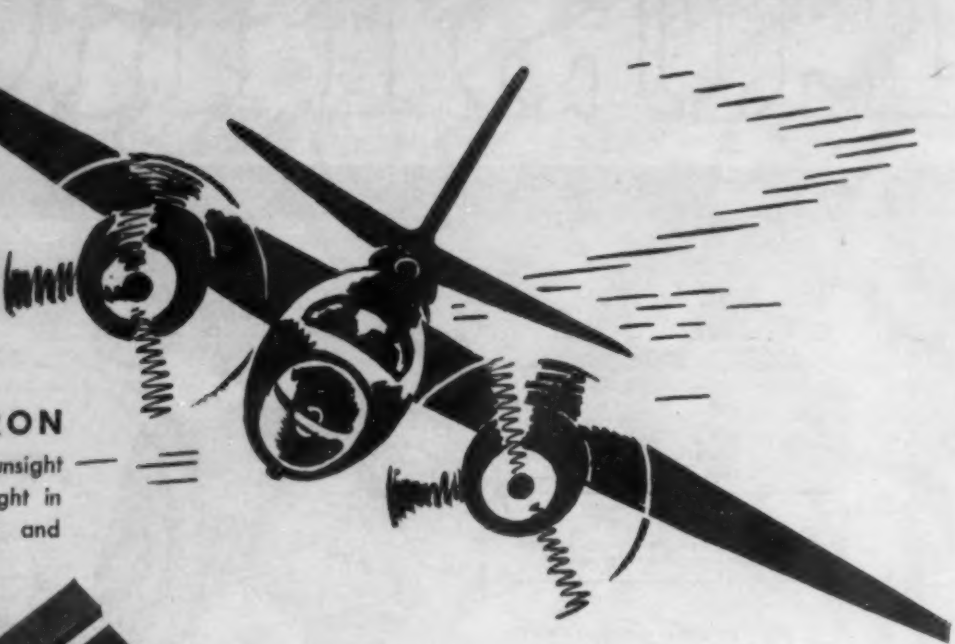
MONSANTO PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

VUEPAK

TRANSPARENT PACKAGING MATERIAL

C-D NON-METALLICS FOR VITAL JOBS



THIS CELORON
Molded Plastic Gunsight Bracket must be light in weight, yet strong and tough.

THESE DIAMOND FIBRE
Glider Fairleads must be light in weight, strong, and highly abrasion resistant.

THIS DILECTO
Angle, used to brace baffles in a Bullet Sealing Fuel Tank, must be strong but resilient, and must be oil and gasoline proof.

CONTINENTAL-DIAMOND Non-metallic materials offer designers a wide range of desirable properties . . . controlled by C-D Engineering to meet specific electrical, mechanical and thermal problems.

- Extreme Strength
- Light Weight
- Resilience
- Moisture Resistance
- Chemical Resistance
- High Electrical Insulating Properties
- Heat and Cold Resistance
- Readily Fabricated

C-D Non-metallics are available in standard forms of sheets, rods and tubes . . . or in parts fabricated to specifications . . . for complete technical and mechanical data, send for Bulletin GF.

DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C.
West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities

CM-44

Continental-Diamond FIBRE COMPANY

Established 1895. . Manufacturers of Laminated Plastics since 1911—NEWARK 28 • DELAWARE

APPLIED PLASTICS

DIVISION OF KEYSTONE BRASS WORKS INC.

ERIE, PENNSYLVANIA

Gentlemen:

Can you afford to compromise?

There is a material suited to every application and there are processes and equipment suited to every material.

APPLIED PLASTICS is more than the name of our organization. It is our purpose to give:

To the ultimate consumer, the application of exactly the right plastic to the decorative purpose or mechanical function desired;

And, to the manufacturer of the molding compound, the application of his material to the right specific requirements.

Our engineering skill, directed by years of experience with all kinds of materials and processes, is yours for the asking.

Drop APPLIED PLASTICS a line. We assure you of prompt and unprejudiced opinion to assist in selection of materials and details of design.

Immediate attention given to war products, prompt attention to items of post war planning.

Yours very truly,

APPLIED PLASTICS DIVISION
KEYSTONE BRASS WORKS

Ben Bowlus
General Manager

BHBowlus/el

Impact extrusions

uncover your Imagineering instincts

Put a plastic cap on this aluminum impact extrusion, as Alcoa's customer does, and you have the container for an electrical coil. But show it to an "Imagineer" and you hear a dozen different ideas—

Flare its open end to make an unusual, attractive vase—Turn it upside down on a plastic base, wire it for electricity, and you have a beautiful table lamp—Extend those fins even more than here, and you get a superior heat-radiating case for any kind of electrical or mechanical equipment. And so the suggestions go, on and on.

But the method of making this part—the impact extrusion process—is even more intriguing. One wallop of a press on an aluminum blank and it is formed, ribs on the inside or out, bosses in the bottom, if needed. The Alumilite finish (process patented) may be added, increasing corrosion resistance and making the shell most attractive, in plain aluminum or a variety of other colors.

Final costs are often less when you start with Alcoa impact extrusions, because so little work is required to complete them. Winning the war comes first, but aluminum is now being used for other-than-war purposes as the manpower situation permits. Our representative will be glad to discuss the availability of aluminum with you. Write Aluminum Company of America, 2175 Gulf Building Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM

It's the Laboratory Behind the Product . . . *that Guarantees Results*

TAKE the best ingredients obtainable, compound them under relentless laboratory control, toss in a pinch of "know how", add 18 years of chemical manufacturing experience—it's the recipe that produced the McAleer *tailored-to-fit-the-job* bar of composition shown above.

Rigid Laboratory Control insures *uniform* quality in *every* shipment

Though sold by the pound, this production finishing material represents a *value far beyond purchase price* to its User. The value? Extra performance on the job, less waste, elimination of rejects, greater work output and lower operating costs.

On your next problem involving burring, polishing, buffing of metals or finishing of plastics, let McAleer provide the answer with a *quality-controlled* composition formulated to do an exacting job, do it well and keep on doing it as long as the need exists.

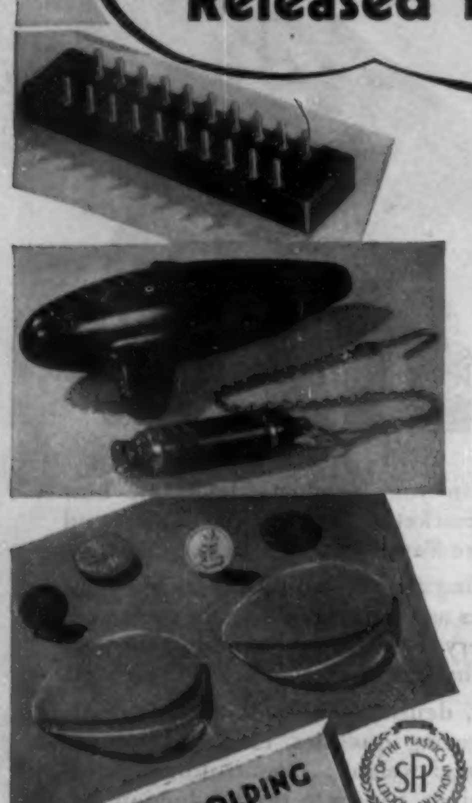
Standards protect the manufacturer of materials which are buffed or polished; but when your compositions bear the McAleer trade mark, you get more than standards—you are protected all the way. *Use the laboratory behind the product* for results. Use McAleer.

On the Transportation Front, McAleer Rubbing Compounds, Waxes, Polishes and Cleaners help to maintain the After-Victory-Value of thousands of America's Cars, Trucks and Buses.

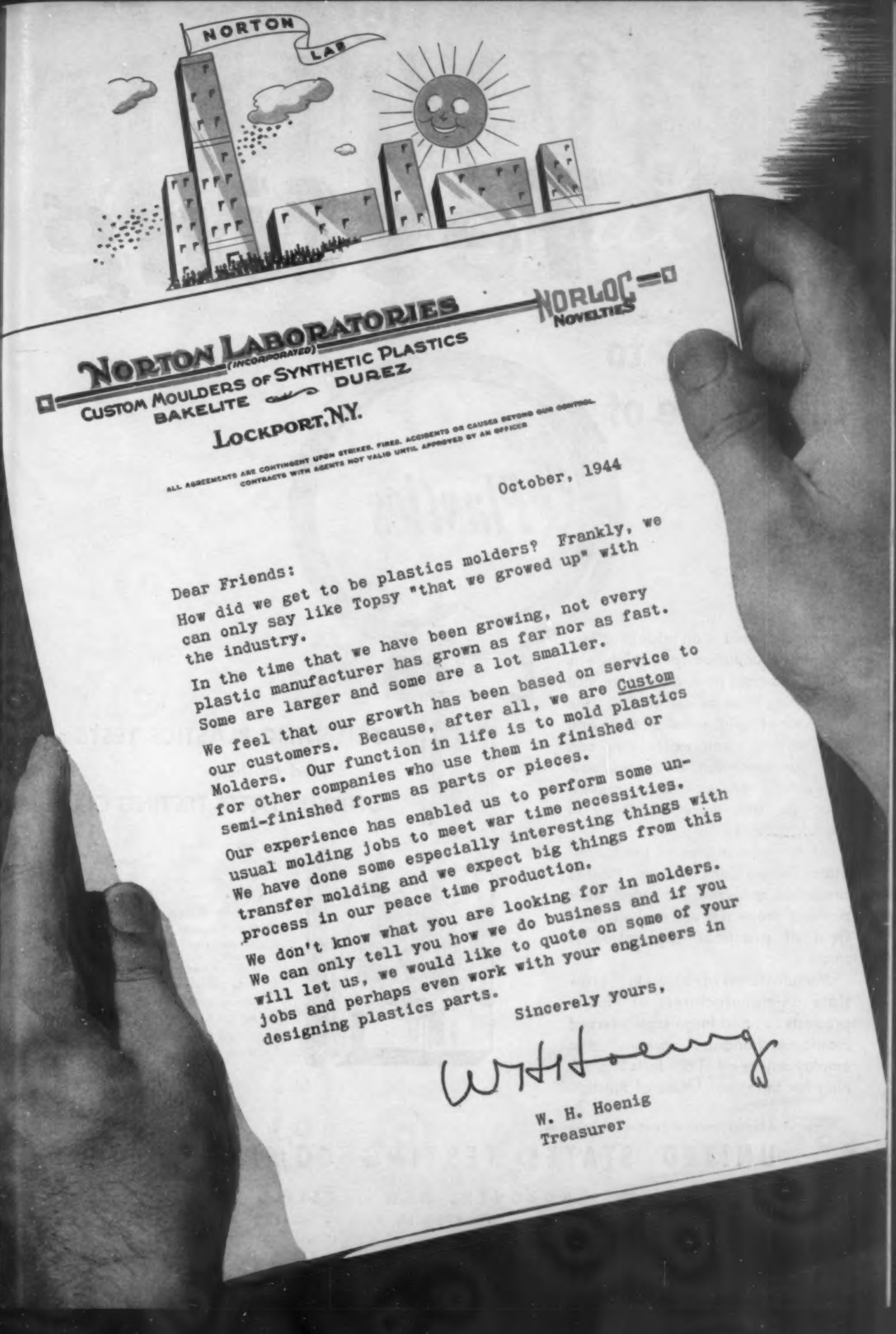
McAleer MANUFACTURING CO.

Manufacturers of Quality Controlled Finishing Materials

ROCHESTER, MICHIGAN


PLASTIC MOLDING
PLASTIC LIGHTING FIXTURES
METAL SUNDRIES
EYELETS · TOYS
UNIFORM & DRESS BUTTONS
Our Engineers and Designers will work with you


RIGHT...OUT OF THE BLUE



NORTON LAB

NORTON LABORATORIES (INCORPORATED)
NORLOC NOVELTIES
CUSTOM MOULDERS OF SYNTHETIC PLASTICS
BAKELITE — DUREZ
LOCKPORT, N.Y.

ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, FIRES, ACCIDENTS OR CAUSES BEYOND OUR CONTROL.
CONTRACTS WITH AGENTS NOT VALID UNTIL APPROVED BY AN OFFICER

October, 1944

Dear Friends:

How did we get to be plastics molders? Frankly, we can only say like Topsy "that we growed up" with the industry.

In the time that we have been growing, not every plastic manufacturer has grown as far nor as fast. Some are larger and some are a lot smaller.

We feel that our growth has been based on service to our customers. Because, after all, we are Custom Molders. Our function in life is to mold plastics for other companies who use them in finished or semi-finished forms as parts or pieces.

Our experience has enabled us to perform some unusual molding jobs to meet war time necessities. We have done some especially interesting things with transfer molding and we expect big things from this process in our peace time production.

We don't know what you are looking for in molders. We can only tell you how we do business and if you will let us, we would like to quote on some of your jobs and perhaps even work with your engineers in designing plastics parts.

Sincerely yours,

W H Hoenig

W. H. Hoenig
Treasurer

SCIENTIFIC *Testing*

The *Key* to the future of *Plastics*

The Plastics field is an infant industry . . . the foundation for its future is being laid right now. Make sure that foundation is set on bed-rock . . . the bed-rock of solid, scientific facts and information upon which you can plan for expansion, new uses, new products, improvements in present products, and more efficiency in manufacture.

At the laboratories of the United States Testing Company, Inc., Plastics are tested, analyzed, evaluated. Their physical properties are probed, their field of practical application is studied.

Manufacturers of Plastics in the raw state . . . manufacturers of Plastic products . . . and large scale users of Plastic merchandise . . . are invited to employ any or all of our tests in planning for the great future of Plastics.

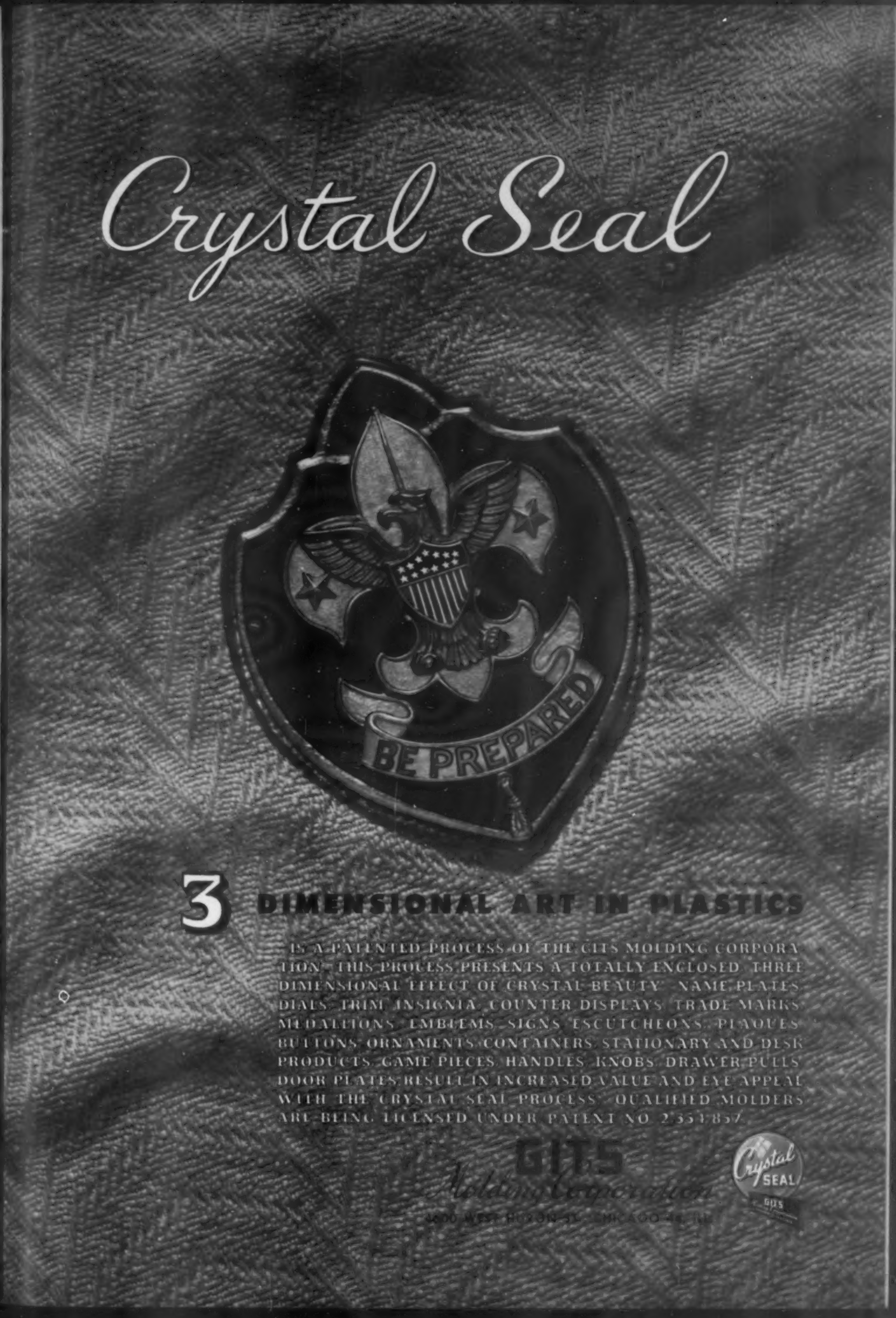
SCIENTIFIC PLASTICS TESTS
performed by the
UNITED STATES TESTING CO., Inc.

Impact Strength	Light Diffusion
Flexural Strength	Color Fastness
Compressive Strength	Flammability
Tensile Strength	Resistance to Chemical Reagents
Modulus of Elasticity	Power Factor and Dielectric Constant
Distortion under Heat	Dielectric Strength
Deformation under Load	Insulation Resistance
Rockwell Hardness	Volume Resistivity
Mold Shrinkage	Hardness
Density	Thermal Conductivity
Hot Oil Test	Specific Heat
Acetone Extraction	Thermal Expansion
Water Absorption	Molding

Write for Price List of our complete testing service

Member of American Council of Commercial Laboratories

UNITED STATES TESTING COMPANY, INC.
ESTABLISHED 1880
HOBOKEN, NEW JERSEY
PHILADELPHIA, PA. • BOSTON, MASS. • WOONSOCKET, R. I. • CHICAGO, ILL. • NEW YORK, N. Y.



Crystal Seal
BE PREPARED
3 DIMENSIONAL ART IN PLASTICS
IS A PATENTED PROCESS OF THE GITS MOLDING CORPORATION. THIS PROCESS PRESENTS A TOTALLY ENCLOSED THREE DIMENSIONAL EFFECT OF CRYSTAL BEAUTY. NAME PLATES, DIALS, TRIM, INSIGNIA, COUNTER DISPLAYS, TRADE MARKS, MEDALLIONS, EMBLEMS, SIGNS, ESCUTCHEONS, PLAQUES, BUTTONS, ORNAMENTS, CONTAINERS, STATIONARY AND DESK PRODUCTS, GAME PIECES, HANDLES, KNOBS, DRAWER PULLS, DOOR PLATES RESULT IN INCREASED VALUE AND EYE APPEAL WITH THE CRYSTAL SEAL PROCESS. QUALIFIED MOLDERS ARE BEING LICENSED UNDER PATENT NO. 2,354,857.
GITS
Molding Corporation
Crystal SEAL
GITS

A NEW BULLETIN ON BANBURY MIXERS IS NOW READY

A FEW BANBURY ADVANTAGES

1. More uniformly mixed stocks produced.
2. Positive, automatic, mechanical control of entire mixing procedure.
3. Savings in production costs often sufficient to pay for an installation in a year or less.
4. Less floor space for equal output.
5. More efficient and economical handling of materials.
6. Close control of mixing temperatures.
7. Safer and cleaner operating conditions.
8. Variety of materials, colors or formulas processed without difficulty.

THIRTY-TWO pages of description and illustrations give up-to-the-minute details of the latest developments in Banbury Mixers.

The many applications of this money-saving and product-improving machine in the rubber, plastics, linoleum, asphalt, paint and other fields are discussed . . . features of design and construction are described . . . a table of sizes, capacities, dimensions, etc., is included . . . specific information on installation and operation is given.

A number of photographs illustrating the various sizes and types of machines for different applications are shown. Drawings of typical arrangements of Banbury Mixers with auxiliary equipment are also included.

WHY NOT WRITE FOR YOUR FREE COPY TODAY? ASK FOR BULLETIN NO. 180

FARREL-BIRMINGHAM COMPANY, INC., Ansonia, Conn.
Plants: Ansonia and Derby Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles

Farrel-Birmingham

BAKER'S P-8

[Glyceryl Tri-aceto-ricinoleate]

a LOW-COST Plasticizer for Synthetic Elastomers

For Use In:

GRS
NEOPRENE GN
PERBUNAN
POLYVINYL CHLORIDE
COPOLYMERS OF POLYVINYL CHLORIDE
ETHYL CELLULOSE (ETHYL RUBBER)

As a plasticizer, Baker's P-8 contributes to:

1. Speed and ease of compounding.
2. A flexible stock with good physical characteristics.
3. Flexibility at low temperatures.
4. Retained Flexibility (P-8 exhibits extremely low volatility at elevated temperatures).

The plasticizing effect of P-8 for Perbunan
(40 parts of plasticizer)

Plasticizer	% Vol. 48 hrs. @ 150°C.	Flex. to °C.	Modulus @ 300%	Tensile psi	Elong. %	Set %	Shore Hard.
None	Nil	–30	2175	3225	395	15	75
P-8	1.6	–60	400	1650	665	20	45
Tricresyl Phosphate	9.5	–50	750	1475	515	25	60
Glycol Ester of Low Molecular Weight Fatty Acids	12.1	–60	550	1650	570	20	45

THE BAKER CASTOR OIL COMPANY

Established 1857

120 BROADWAY, NEW YORK 5, NEW YORK

Jersey City, New Jersey — Los Angeles, California — Bayonne, New Jersey

Dresser set molded for L. Batlin and Son, Inc., importers.

The bright beauty of plastics will make all of living easier, lovelier—more colorful—tomorrow. How far away is tomorrow? It could be right around the next corner.

Already we are working on designs and molds for lovely, practical, useful things for civilian use—like this exquisite dresser set we have molded of Lucite. Our drafting room is busy with the plans of many manufacturers who want to make their products more durable — more functional — more beautiful — with plastics.

If you are designing for tomorrow—if you want to utilize the clean, lustrous surfaces, the beautiful colors and transparencies, the sturdy adaptability of plastics, consult Watertown engineers today. Their function is to assist you in planning on design, materials and formulae that will give you the finest plastics for your new products. The Watertown Manufacturing Company, Watertown, Connecticut. Branch office—Cleveland, O. Sales offices—New York, Chicago, Detroit, Milwaukee.

Watertown

A NAME AS OLD AS THE PLASTICS INDUSTRY

SOMETHING TO SPOUT ABOUT

The plastic piece illustrated above is a component of the Whirl-A-Way Insector Spray . . . and to qualify as such the requirements for its design and construction were most exacting. Certain chemicals were to pass thru its cavities — thus necessitating the use of a plastic material inert to chemical reaction. The action exerted upon the crystals, by a forced air stream, created a gas-like snow; its formation and efficient ejection, therefore, demanded a leak-proof assembly and an accuracy of manufacture to the closest possible tolerance.

For the material, Consolidated chose a special black Phenolic, and for its production, designed and built a two-cavity, semi-automatic transfer mold die, involving removable threaded plugs, cam-operated core pins and a mold parting line departing from the straight plane.

The piece as finished weighs 3¾ ozs., has a wall thickness of .100" and is giving a good account of itself in service . . . as is also one other Consolidated plastic part in this assembly . . . the injection molded clear acetate cover.

In detailing this achievement we have in mind that we may be able to help others with similar problems; if so we solicit the opportunity.

Above—Demother Spray Body
To Left—Demother Spray Body Cover

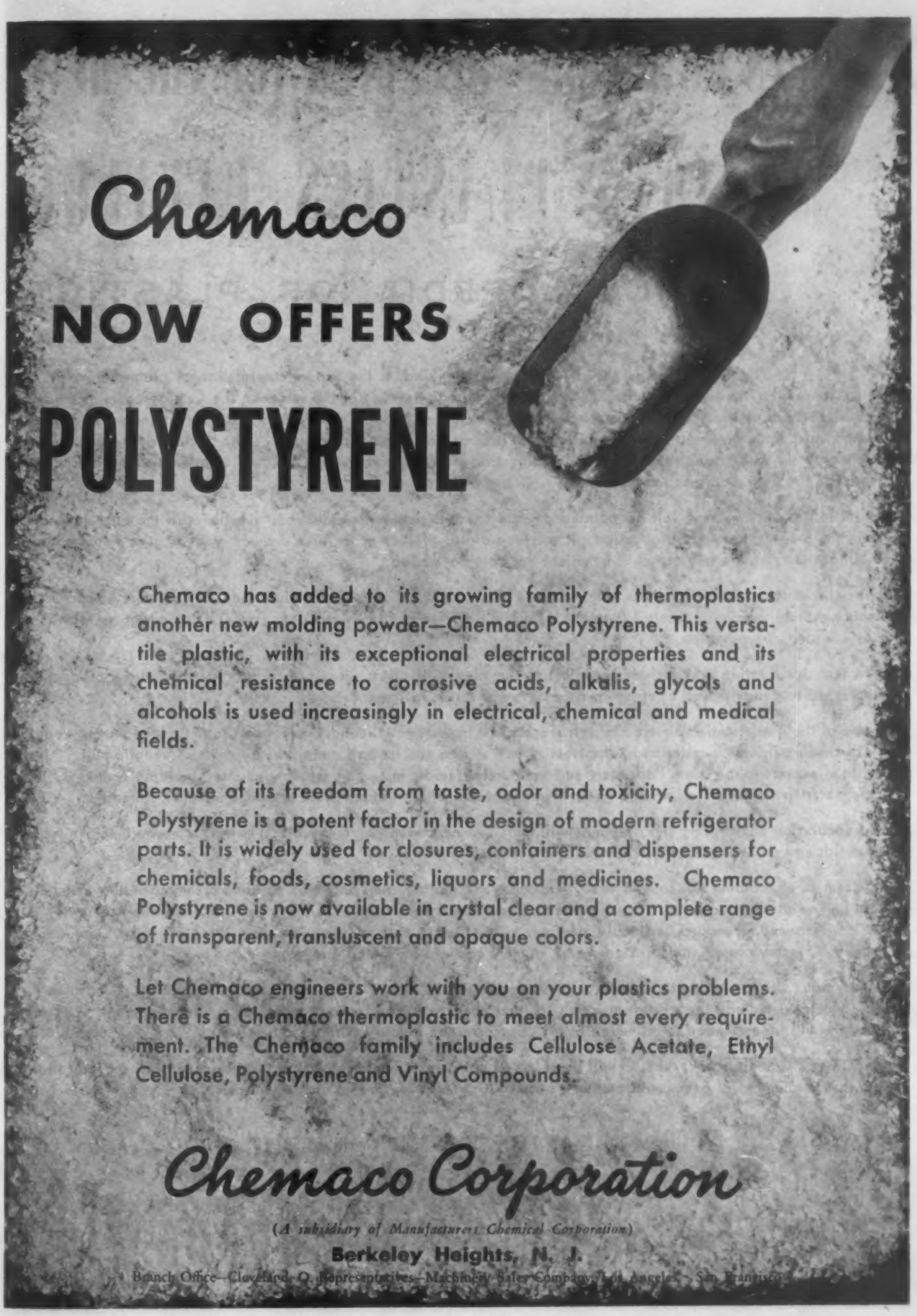
The Whirl-A-Way Insector Spray completely assembled . . . a product of Air-Way Electric Appliance Corporation, Toledo, Ohio.

NEW YORK • BRIDGEPORT • CLEVELAND • DETROIT • CHICAGO

CMP

Consolidated
MOLDED PRODUCTS *Corporation*
309 CHERRY STREET, SCRANTON 2, PA.

YOUR BLUEPRINT IN PLASTIC


Chemaco
NOW OFFERS
POLYSTYRENE
Chemaco has added to its growing family of thermoplastics another new molding powder—Chemaco Polystyrene. This versatile plastic, with its exceptional electrical properties and its chemical resistance to corrosive acids, alkalis, glycols and alcohols is used increasingly in electrical, chemical and medical fields.
Because of its freedom from taste, odor and toxicity, Chemaco Polystyrene is a potent factor in the design of modern refrigerator parts. It is widely used for closures, containers and dispensers for chemicals, foods, cosmetics, liquors and medicines. Chemaco Polystyrene is now available in crystal clear and a complete range of transparent, transluscent and opaque colors.
Let Chemaco engineers work with you on your plastics problems. There is a Chemaco thermoplastic to meet almost every requirement. The Chemaco family includes Cellulose Acetate, Ethyl Cellulose, Polystyrene and Vinyl Compounds.
Chemaco Corporation
(A subsidiary of Manufacturers Chemical Corporation)
Berkeley Heights, N. J.
Branch Office—Cleveland, O. Representatives—Machinery Sales Company, Los Angeles - San Francisco

Santay

SYMBOL OF PRECISION CRAFTSMANSHIP

SANTAY CORPORATION

FORMERLY SINKO TOOL & MANUFACTURING CO.

351-359 NORTH CRAWFORD AVENUE • CHICAGO 24, ILLINOIS

REPRESENTATIVES: POTTER & DUGAN, INC., 29 WILKESON STREET, BUFFALO 2 • PAUL SEILER, 7779 CORTLAND AVENUE, DETROIT 4 • QUEISSER BROS., 108 E. NINTH STREET, INDIANAPOLIS 2

Santay Corporation introduces its new trademark–

"Symbol of Precision Craftsmanship!"

Whenever you see it associated with a thermoplastic product, metal stamping or electro-mechanical assembly, you'll know that Santay's specialized precision craftsmanship has been and always will be employed to give you the greatest possible satisfaction.

ELECTRONIC
HEATING
TUBES BY
UNITED
ARMY
NAVY
851
949 A
KU 23
311-CH
949 H
872 A
HV 27
HV 18
872
975 A
967
UX-973

BALDWIN SOUTHWARK

PRODUCTION PRESSES

DIE HOBBING ANY RANGE FROM 100 TONS UP!

Precise control and smooth power application are No. 1 needs in die-hobbing . . . and you get them both in Baldwin Southwark presses. Available in a range of capacities; write for Bulletin M-160. The Baldwin Locomotive Works, Baldwin Southwark Division, Philadelphia, Penna. U.S.A. District offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, St. Louis, San Francisco, Houston.

BALDWIN PRODUCTS

RUBBER SHEARS

VERTICAL AND HORIZONTAL VULCANIZER

SOLE AND HEEL PRESSES

STEAM PLATEN PRESSES

BELT PRESSES

ROLLED STEEL STEAM PLATENS FOR PRESSES

BLW THE BALDWIN GROUP

BALDWIN
SOUTHWARK
HYDRAULIC PRESSES

OH YES! THIS NEW SAW CUTS PLASTICS BETTER

DoALL Buttress — THE NEW WIDE-SPACED HARD TOOTH SAW

Does Faster, Cleaner Cutting of

• Methyl Metacrylate • Cellulose Acetate • Phenolic • Polystrene • Vinyl Resin • Plywood • Builders Board • Rubber

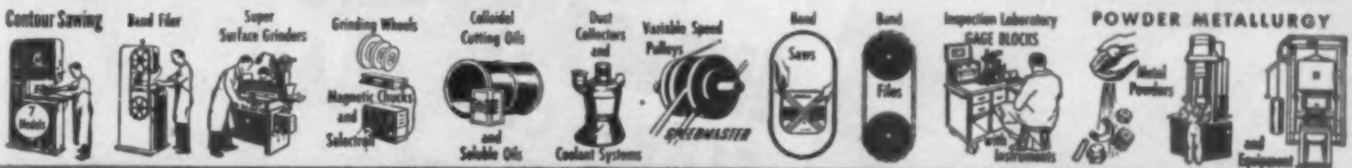
First developed by DoALL engineers to help aircraft production over the hump, the DoALL Buttress Saw Blade is rapidly finding its way into plants everywhere for contour and straight-line cutting of extra-hard, porous, and every type of tough material that other saws can't handle.

The DoALL Buttress does the work in a fraction of the former time and fits any band sawing machine.

IMMEDIATE DELIVERY—Available in widths of ¼", ½", ¾" and 1" and various pitches at all DoALL Supply Points.

NO RE-SHARPENING

The DoALL Buttress Saw will last longer than ordinary saws, so it's economical to use until completely worn out—no work stoppage for re-sharpening—and then place a new saw on the machine.



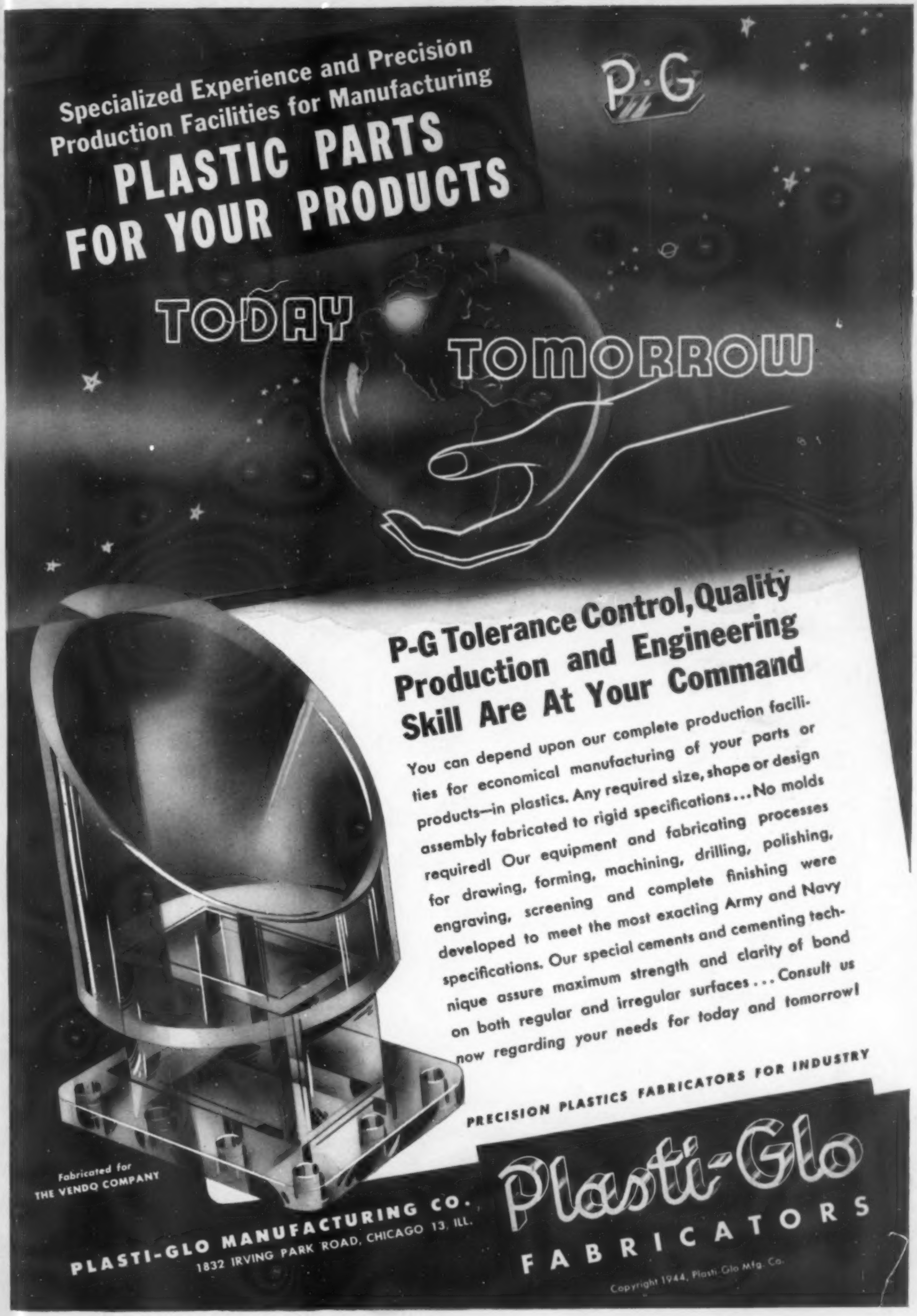
DoALL

INDUSTRY'S NEW SET OF TOOLS

Send for Circular and Full Information

THE DoALL COMPANY
222 N. Laurel Ave., Des Plaines, Ill.

Sales & Service Offices: Baltimore, Boston, Chicago, Cleveland, Denver, Detroit, Erie, Houston, Indianapolis, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Orlando, Philadelphia, Pittsburgh, Rochester, Rockford, St. Louis, San Francisco, Seattle, Toledo, Tulsa, West Hartford.


Specialized Experience and Precision
Production Facilities for Manufacturing
PLASTIC PARTS
FOR YOUR PRODUCTS
P-G
TODAY
TOMORROW
P-G Tolerance Control, Quality
Production and Engineering
Skill Are At Your Command
You can depend upon our complete production facilities for economical manufacturing of your parts or products—in plastics. Any required size, shape or design assembly fabricated to rigid specifications... No molds required! Our equipment and fabricating processes for drawing, forming, machining, drilling, polishing, engraving, screening and complete finishing were developed to meet the most exacting Army and Navy specifications. Our special cements and cementing technique assure maximum strength and clarity of bond on both regular and irregular surfaces... Consult us now regarding your needs for today and tomorrow!
PRECISION PLASTICS FABRICATORS FOR INDUSTRY
Fabricated for
THE VENDO COMPANY
Plasti-Glo
FABRICATORS
PLASTI-GLO MANUFACTURING CO.
1832 IRVING PARK ROAD, CHICAGO 13, ILL.
Copyright 1944, Plasti Glo Mfg. Co.

1,000,000 Plastic CABINETS

...HAVE PAVED THE WAY FOR YOUR POSTWAR RADIO

If you own a table model radio, the plastic cabinet may very likely bear the MPc mold mark . . . because the million-and-more cabinets molded here house a considerable percentage of all the table model radios ever made. Our pre-war production included more than 30 styles for several leading manufacturers.

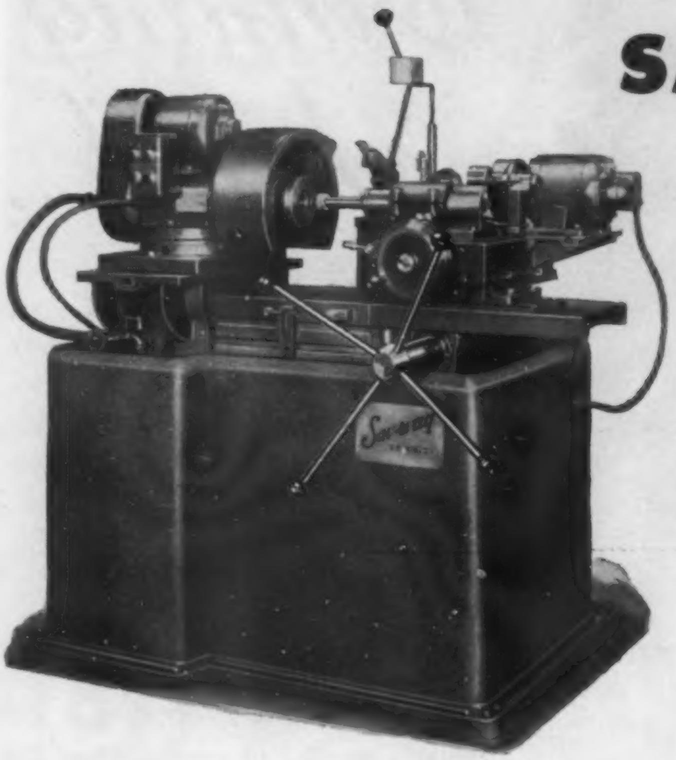
This large-scale operation has necessarily taught us a good deal about volume plastics production. And it also constitutes self-evident proof of our ability to "deliver the goods."

Perhaps *your* postwar product can be benefitted by a serviceable plastic housing with its beauty of line, color and "feel." Or you may require plastic knobs, handles or internal members for structural or insulating purposes. Whatever your needs, we invite you to submit your problem to our engineering staff. We now have free time to assist you in development work . . . or will be glad to quote prices based on your specifications. MOLDED PRODUCTS COMPANY, 4533 W. Harrison St., Chicago 24, Ill.

PLASTICS DIVISION

MOLDED MPc PRODUCTS

Only 30 of these Slightly Used



SAV-WAY HAND INTERNAL GRINDERS

CEILING PRICE $4,970.00

NET PRICE $3,995.00

WIRE COLLECT FOR ACTUAL PHOTOS AND SPECIFICATIONS

- ★ **No Priority Needed**
- ★ **Immediate Delivery**
- ★ **New Machine Guarantee**
- ★ **Equipped with Famous Gold Seal Spindle**
- ★ **Neoprene Insulated against Vibration and Distortion**
- ★ **Ideal Machine for Postwar and Tool Room Work**
- ★ **Practical Service Engineer Will Demonstrate in Your Plant**

Sav-Way **INDUSTRIES**
• Machine Tool Division •
BOX 117, HARPER STATION, DETROIT 13, MICHIGAN

BUILDERS OF HAND AND HYDRAULIC INTERNAL GRINDERS • PRODUCERS OF GOLD SEAL SPINDLES • PLUG GAGES • MICROMETER CHECKERS PRECISION AIRCRAFT, AUTOMOTIVE, AND ORDNANCE PARTS

Planning ahead...

Planning beyond tomorrow...and the day after tomorrow...planning for after-the-war period when fuller knowledge and experience born of war needs will have a new rebirth in the planning of peacetime commodities. In your plans of plastic application to future products, be they television to functional kitchens or paper-thin diaphragms to beautiful bathrooms, look to RESIN FIBRE PLASTICS for a probable and favorable solution to your problem. We do not profess to know the shape of things to come...but we do know RESIN FIBRE PLASTICS will be a valuable contribution in shaping them; for this is a versatile material, possessing important diversified adaptabilities, such as high physical values ...pliability of formulation...solution of difficult contours...structural advantage of large sizes...all important to future usefulness of essential products. We will be glad to contribute further information on problems you may have in "planning ahead."

LICENSING MANUFACTURERS

BRANTFORD, CANADA • BUENOS AIRES, S. AMERICA
LONDON, ENGLAND • SYDNEY, AUSTRALIA

ST. CHARLES
ILLINOIS

MOULDED FIBRE PRODUCTS

Hawley

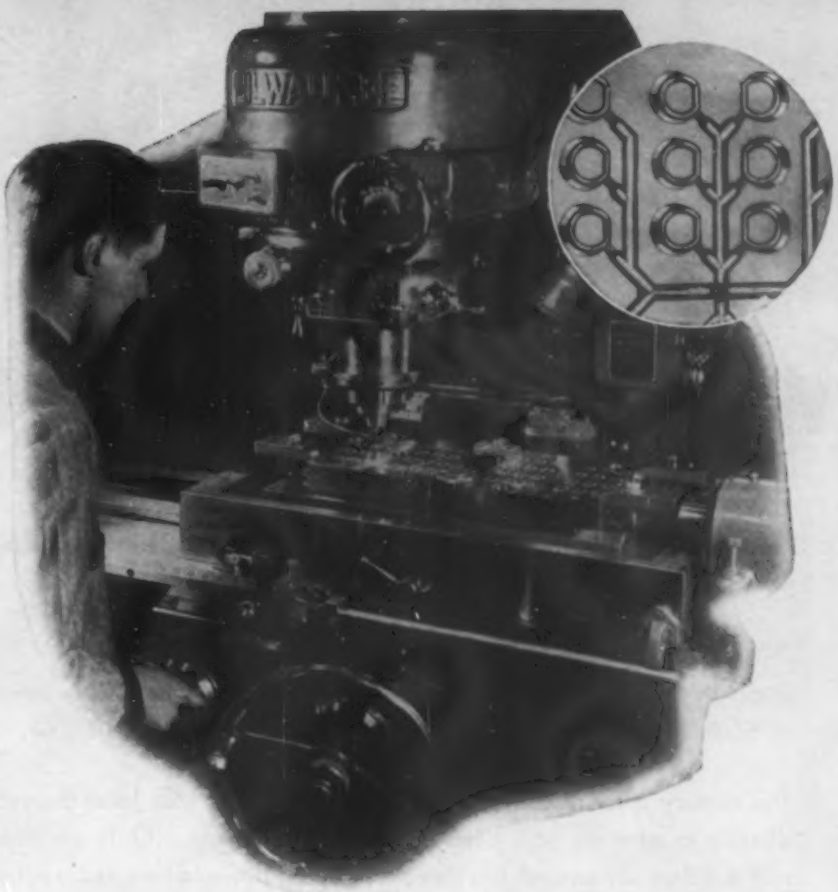
RESIN FIBRE PLASTICS

PRODUCTS COMPANY

24 CAVITY MOLD FINISHED IN 18 HOURS!

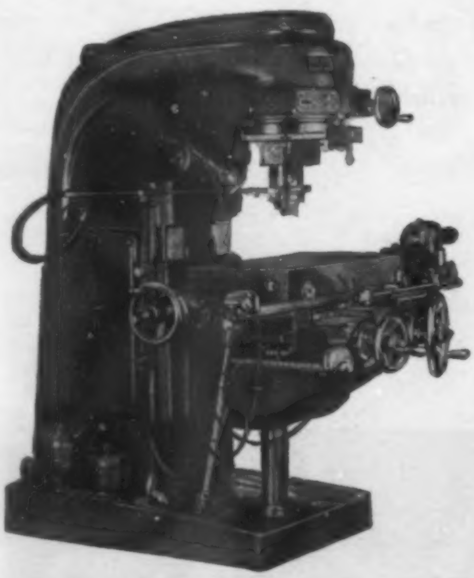
Estimated time required by other methods was more than 100 hours!

THE two halves of the 24 cavity mold were aligned and properly spaced on the Milwaukee Rotary-Head Milling Machine table. The first milling operation was performed on the first cavity in the back row. Then, by moving the table the proper distance — the same operation was performed on the next cavity. Since the cavities in the two mold halves were identical, this and succeeding operations were simply carried over to the opposite half of the mold. Each operation was readily performed in proper sequence and the entire 48 impressions of the 24 cavity mold were machined completely at a single set-up in 18 hours.



KEARNEY & TRECKER'S ROTARY HEAD MILLER

The Most Versatile Machine Ever Designed for Mold and Die Work



DIRECT . . . mills mold cavities in a single set-up without the aid of templets or models.

ACCURATE . . . chances for error are eliminated because there is no change in set-up. Exact control of all combinations of cutting movements—possible only with this machine—transmits mathematical precision to the work.

FAST . . . initial job preparation and set-up time is reduced to the minimum. Accurate performance of the machine saves operator's time and rapid production of intricate molds and dies is the result.

•

Write for bulletin No. 1002C for complete information on the Milwaukee Rotary-Head Miller and the accurate and rapid production of all types of molds and dies for plastics.

Rotary Head Milling Machine
•
Autometric Jig Borers
•
Center Scope

Kearney & Trecker Products CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
•
Milwaukee Midgetmill
•
Milwaukee Speedmill

MODERN PLASTICS

OCTOBER 1944 VOLUME 22 NUMBER 2

The Fortress gets another nose

by THOMAS GLADWIN*

THE use of atmospheric pressure in forming thermoplastic sheet is not new. Used in conjunction with forms, it has produced thousands of bomber noses, blisters, etc. This article, however, encompasses "free blown" fabrication. No forms or molds are used, the sheet being restrained only at the edges. The final shape depends entirely upon the vacuum control and the part, naturally, is free of any mark-off that is normally present in form-shaped sheet

WHEN, in the summer of 1943, the chin turret was added to the already impressive armament of the Boeing Flying Fortress, changing its designation to the B-17G, the last "blind spot" was given powerful protection. With two or more .50-caliber machine guns already firing aft, to each side, above and below, two more power-driven guns were added to fire in a large cone directly ahead. In contrast to other such installations, this change did not make necessary the addition of another crew member, for the bombardier now doubles as gunner.

This change immediately presented a number of new problems in the design of the transparent nose of the plane. It was no longer enough that it merely provide visibility, conform to the contour of the airplane, and contain the laminated glass sighting panel for the bombsight. In addition, it had to withstand the terrific muzzle blast of the two guns firing, in maximum elevation, within a few inches of its surface. More difficult still, it had to provide an adequate panel through which the chin turret sight could operate.

Other turrets on the airplane sight through plate-glass panels which revolve with the guns and the sight, and thus have to be optically satisfactory over only a small area. Even these have presented considerable problems. In contrast the chin-turret sight, set back from the nose to be accessible to the bombardier seated at his bombsight, operates through practically the entire upper surface of the nose.

The problems of muzzle blast and clear vision were solved by shortening the nose and removing all stiffening ribs and splices from the upper portion. The stubbier and therefore stronger nose was further removed from the line of fire, and trouble from this source was eliminated. The gunner could swing his sight in all positions without encountering any obstructions to his vision until, in the lowest angles of fire, he passed the upper edge of the bombsight window.

This revised nose was shortly incorporated in production, and the feeling was that all troubles on this score were over. However, operations with the new nose, coupled with increasing precision of the sight itself, soon revealed that such was not the case. The optical distortions inevitably introduced by vacuum forming in a die were too severe, and the efforts of the turret gunner to hit his distant and elusive target were seriously handicapped. These distortions resulted from the unequal stretching of the acrylic resin sheet as it was drawn to contour, from the chilling of the surface of the heated material as it made contact with the die or lubricating material, and from the flow of the lubricant as the vacuum sucked it from under the sheet in the final stages of the draw.

Standards and test procedures were established, in terms of requirements for successful operation of the turret sight, but were abandoned in the light of the prohibitive rate of rejections occasioned by their application. Distortion was so severe that, firing for example at 1000 yd., the gunner could be in error from this source alone by an amount exceeding the total wingspread of most standard fighter airplanes. As the degree and direction of this aberration is not at all evident from merely looking through the nose, the gunner could not introduce any correction in his sighting.

Numerous refinements and revisions of forming procedure and tooling were attempted but without satisfactory improvement in optical properties. Finally, the writer suggested to a West Coast molder, whose company manufactures noses for Lockheed-built B-17's, that he attempt free-blown forming of the upper portion of the nose alone (Figs. 8 to 10), retaining the existing die-formed contour of the lower half for the bombsight panel (Figs. 1 to 7). He enthusiastically accepted the suggestion, and, at his own expense, made five experimental noses in this fashion. The design was submitted to and approved by Boeing and the Army Air Forces, and free-blown noses are now used on all Flying Fortresses currently being produced by Boeing, Douglas and Lockheed.

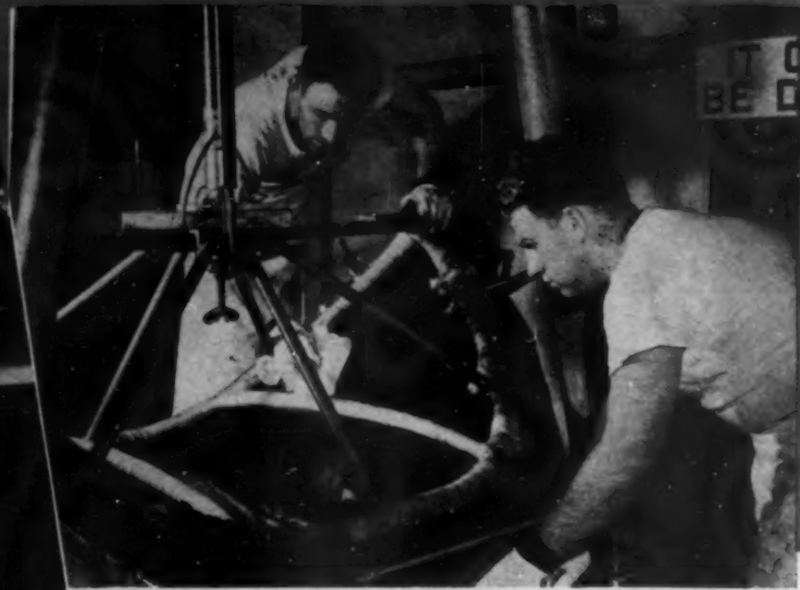
By restraining only the edges of the sheet and pulling the remainder down by vacuum like a huge bubble, stretching of the material is held to a minimum and equalized throughout, and die contact is completely eliminated in the sighting area. This results in an optical error which is easily held to less than 3 mils (approximately $1/6$ of one degree). As this amounts to less than 9 ft. at 1000 yd., it is considerably less than other errors introduced by the human element, dispersion in the fire of the guns, and so forth.

The following four pages are devoted to a series of photographs which reveal all stages of forming, assembling and optically checking these noses.

Credits—Material: Lucite and Plexiglas. Molded by Swedlow Aeroplastics Corp. for Boeing Aircraft Co., Douglas Aircraft Co., Inc., and Lockheed Aircraft Corp.

* Engineer, Lockheed Aircraft Corp.

1



ALL PHOTOS, COURTESY SWEDLOW AEROPLASTICS CORP.

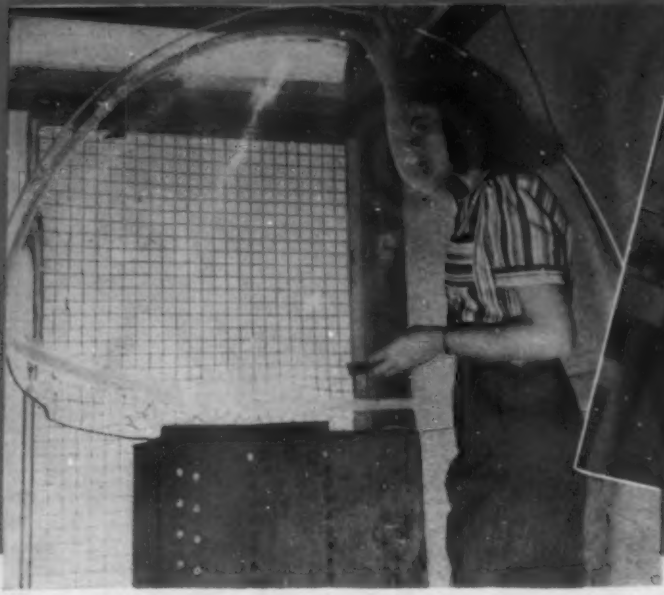
4

1—Material, which is received in sheet form, is first placed in a gas-heated oven set at a temperature of 400° F. for 0.250-in. thick material. Heat is applied to it for 12 minutes. On being removed from the oven, the material is in a rubber-like and flexible condition. 2—A view of the female vacuum mold for the lower half of the nose. Before the sheet is placed in the form, the latter is thoroughly brushed with grease which will absorb any foreign matter present and act as a uniform cooling agent. 3—The heated sheet is properly located in the form to insure a complete seal. The hold-down is then lowered into position over the edges by means of an air-operated ram. Care is exercised to prevent the sheet from touching any part of the die other than the sealing edge. 4—The edges of the heated sheet are held in place by the hold-down, and the sheet is pulled down into contour by a vacuum. 5—After approximately 20 minutes of cooling, the ram is raised, great care being exercized to avoid any scratching. The part is then ready to be degreased

2

5

3

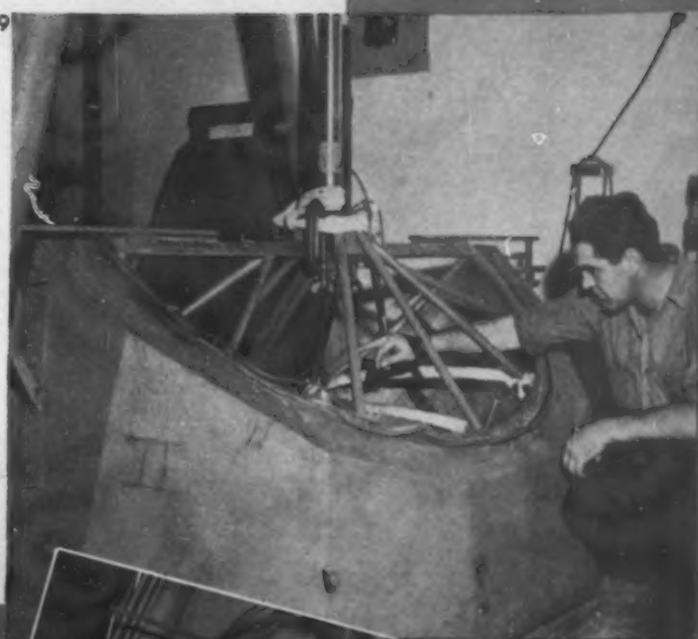


6

7

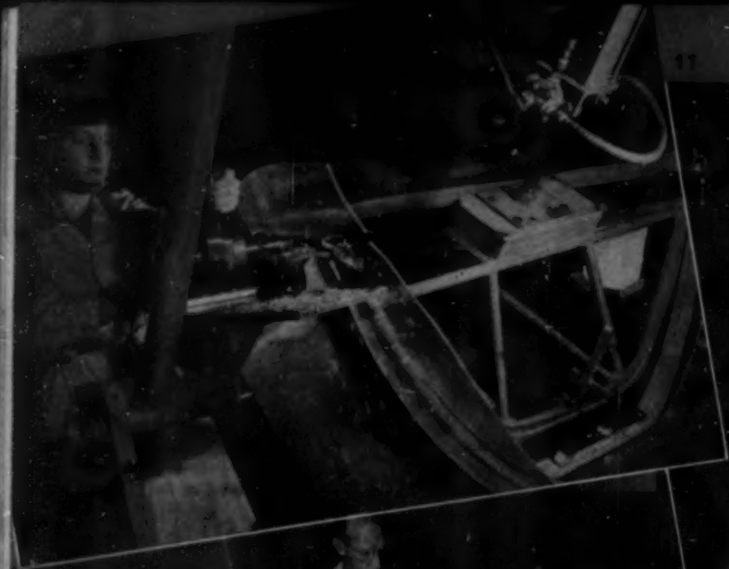
6—On being degreased, the formed part is carefully inspected before a screen grid for distortion and waviness. Optical discrepancies found during this operation are checked before section is finally accepted. 7—Deflection of line of sight due to optical distortion caused by flaws in contour of nose is determined by this inspection fixture. 8, 9 and 10—These figures illustrate forming of the upper section of nose by a technique known as free-blowing in a vacuum form. Heated sheet is placed in form (Fig. 8) and the hold-down makes an airtight seal between sheet and mold. Air is then evacuated between sheet of material and mold, making a vacuum (Fig. 9). Atmospheric pressure compresses the plastic into desired shape. After shaping, sheet is removed from the form (Fig. 10). The most important factor in this operation is to get the desired shape without the plastic's touching the form

9



10

8



11

ALL PHOTOS, COURTESY SWEDLOW AEROPLASTICS CORP.

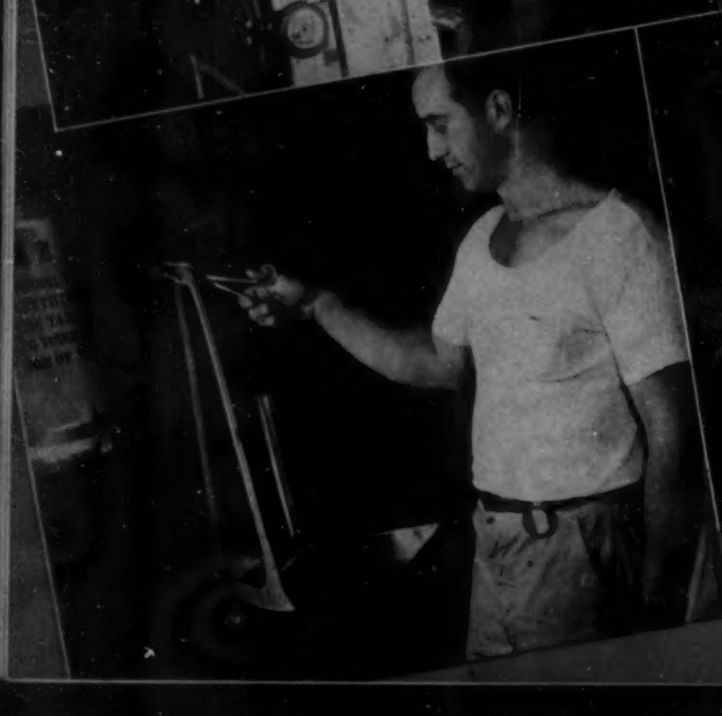
15

12

13

11—Following inspection, upper and lower parts are placed in an elaborate trim jig and surplus material is removed by a router. **12**—*Base strips are clamped and cemented to the nose in a bulkhead jig, and assembly left in jig about an hour under heat.* **13**—*Rib strips are soaked in cement, clamped into the correct position and left to dry for 4 hours. After the ribs are in position, the two sections are cemented together.* **14**—*Bombadier frame shown here has been dip-masked in dope. Area to be cemented to nose is demasked before part is soaked in cement.* **15**—*Frame is removed from the cement bath after 15 minutes. Nose is shown after 2 halves are cemented together and it is being put into a fixture for a trim and hole drilling.* **16**—*After base strips are routed, screw holes are drilled in the base to fasten nose to the ship. A plastic* jig insures accurately located holes*

16



14

17

18

17—*Holes are drilled in bombardier window with a plastic drill powered by air and liquid wax. Jig which holds the part weighs about 500 lb., thereby lessening chance of slipping. The holes will be used to assemble plate glass window and the channels in final assembly department.* 18—*Army and plant inspectors check a finished nose for workmanship, optics, installation.* 19—*Special 3-horse carter router grinds crude base strips smooth to specifications after they emerge from cement bath. For this operation, part is held in special jig designed by the company.* 20—*Spray masking is applied by an air pressure gun to part.* 21—*A final operation performed on the part is grinding and sanding to remove the rough edges of the cement*

19

20

21

The new pin-up girl gives a touch of glamour to her appearance by the addition of these varicolored plastic combs to set off her upswept hair-do. Inspired by a pair of Spanish combs, this new fashion in hair ornaments has swept America and promises to rival the ever-blooming flower in popularity. These *peinetas*, or "little combs," as they are called by their originator, Bee Norton of Los Angeles, are fashioned of plastic disks threaded on wire in intricate designs and attached to combs.

The style appeal of these pin-up combs is so great that they are not limited to evening wear but are in evidence at all times and places—in simple design and color for daytime; in rich pearl and jet for evening. Mother, daughter and even grandma has her own individual fashion to suit her age, hair-do and costume.

Since both disks and combs are molded of cellulose acetate, the new vogue is an all-plastic one. Mrs. Norton purchases the items separately from their individual manufacturers, and a staff of women working under her direction fashion the combs by hand. The designs are planned by her artist son, and if they give evidence of having sales appeal, are immediately put into production. Already the combs (patent pending) have been adopted by leading style centers in the United States, and representatives of fashion leaders in Canada, Great Britain and South America are bidding for their manufacture.

War as a proving ground

by CARL C. AUSTIN, JR.*

NOT long after our men began fighting in the Pacific area they discovered that they were facing not one enemy, but two. The second equally vicious peril was tropical disease—much of it insect-carried—which threatened to account for nearly as many casualties as enemy gunfire. In many theatres of war this hazard has been efficiently controlled by conventional metal-screen cloths, but in the tropical dampness of the New Guinea, Guadalcanal, Tarawa, Kwajalein and Eniwetok areas, corrosion made short work of these materials. It soon became apparent that a screen cloth was needed which would withstand the rigors of tropical climate and yet have strength and durability at least equal to metal.

The answer to this problem was finally found in a plastic insect screen cloth which has become an important weapon of war in many U. S. outposts. Experiments with plastics, begun before the war, had resulted in screens of nylon,[1] plastic-coated yarns[2] and extruded saran.[3] In the early months of 1942, after testing the various monofilaments, Chicopee Manufacturing Corp. of Georgia—well-known to the cotton textile trade—began production of millions of square feet of insect screen cloth—extruded from a powder into a monofilament and then woven from the saran monofilaments. The cloth was immediately snapped up for exclusive war uses where its extreme ruggedness, durability, light weight, and immunity to corrosion, dampness, mildew and tropical heat soon made it in great demand as a protection against insect-carried tropical diseases.

Exhaustive tests by the Bureau of Standards have indicated that accelerated weathering treatment has no appreciable effect on the tensile strength of this plastic material, nor does the cloth have any tendency to deteriorate in any way. Other Bureau of Standards tests have indicated that when subjected to 150° F. for a period of 48 hr., the material suffered little shrinkage—less than any other plastic screen cloth thus far subjected to this treatment.

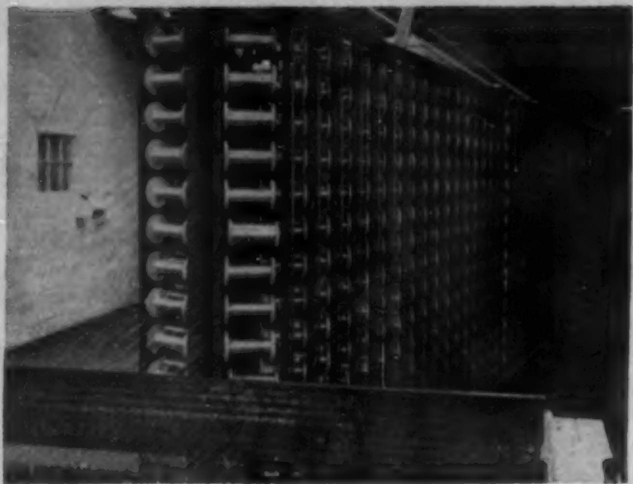
The tensile strength of the vinylidene chloride filament runs as high as 50,000 p.s.i., which makes it highly resistant to damage and abuse. Because of its extreme resiliency, the cloth also resists dents and bulges. In a recent test by the company in which a 1-lb. metal ball was dropped from various heights onto a framed section of the screening material, the plastic, when securely framed, was found to be able to withstand, without breaking, an impact more than six times greater than conventional screen cloth.

When the possibility arose of using this cloth in areas subject to sub-zero temperatures, experiments were conducted for this firm by the Electrical Testing Laboratories to determine the effect of cold weather on the material. Even after being subjected to a temperature of −30° F. for 24 hr., a 2 by 3-ft. frame of this plastic was able to withstand the im-

* Chicopee Manufacturing Corp.
[1] MODERN PLASTICS *20*, 64 (July 1943).
[2] MODERN PLASTICS *20*, 70 (March 1944).
[3] MODERN PLASTICS *20*, 50 (September 1943).

1—Soldiers fighting in the Pacific area have found that insect screen cloth of vinylidene chloride filaments installed in the side walls of tents forms a more than adequate safeguard against the attack of malaria-bearing insects

OFFICIAL PHOTOGRAPH U. S. NAVY



ALL PHOTOS, COURTESY CHICOPEE MFG. CORP.

2

3

2—Hundreds of spools of monofilament, mounted on a creel, are wound on the warp beam. 3—The monofilaments are then fed into a Draper loom from the warp beam. 4—The material, shown from the cloth side, is woven on a standard textile loom modified to withstand the greater tension induced by the material. 5—An inspector carefully checks the cloth for flaws before it is shipped

pact of a 1-lb. ball dropped from a height of 2 ft. without rupture and with only slight distortion.

For the past two years, this material has been under strict allocation by the War Production Board for overseas use and its demand for war purposes has continued to exceed the availability of the raw materials.

Varied applications

The success of this plastic in malaria control is attested by the fact that, at the request of the Bureau of Medicine and Surgery of the Navy, it is now installed in the side walls of tents in the Pacific area. The flap into which this plastic screen cloth is sewn is used in addition to the regular tent side walls. During good weather the regular canvas wall is rolled up. The remaining screened flap affords ventilation while effectively barring the entrance of insects.

Experience to date has shown that this plastic cloth will outlast the tent canvas to which it is sewn, as well as any type of metallic screening which has been used thus far in the Pacific area. An unforeseen virtue of this material relates to its flameproof qualities. The canvas used in the construction of Navy tents is treated with a fireproofing compound during the process of manufacture. When subjected to repeated rain after continued use in the field, this fireproofing compound has a tendency to wash out. As a result, the tent will burn to some extent. However, it has been found that if the bottom part of the flap, in which this plastic screen cloth is used, does catch on fire as from a ground fire, the flames will be halted when they reach the plastic material, thus saving the rest of the tent.

The use of this cloth, woven of vinylidene chloride monofilaments, as an insole for jungle boots was developed by the Quartermaster Corps to afford the maximum of ventilation between the foot and the rubber sole of the boot. Field tests have indicated that a sharp reduction in fungus foot diseases may be expected from use of this new type of insole as it removes most of the conditions under which these fungi thrive. This is of great importance in the tropics where, partly because feet are continuously damp, as from perspiration, such diseases as athlete's foot, Dohbie's itch, Singapore foot and Tinea are prevalent.

Since the plastic insole is virtually non-absorbent and quick drying, it lends itself to easy sterilization or washing with soap and water if no stronger disinfectant is available. In addition to these characteristics, the plastic insole is said to be tougher and more comfortable than the previous type.

Standard textile equipment used for weaving

A unique feature of the Chicopee company's weaving process is the fact that standard textile (*Please turn to page 198*)

4

5

THE 6 X 42 BINOCULAR*

by LIEUT. W. RUSSELL BAILEY** and GORDON M. KLINE†

OFFICIAL PHOTO, U.S. NAVY

PHOTO, COURTESY U.S. NAVAL OBSERVATORY

IN April 1942 the Joint Optics Committee of the Army-Navy Munitions Board called a meeting of representatives of the Army and Navy to discuss possible replacement materials for the aluminum used in binocular bodies, aluminum being at that time among the more critical materials. The Material Officer of the Naval Observatory, Commander T. O. Brandon, recommended to the committee that binoculars be fabricated from a serviceable plastic material. Conferences were held at the Naval Observatory under the auspices of the Material Officer with representatives of the Society of the Plastics Industry, individual manufacturers of plastics and binoculars, and various Government agencies for the purpose of discussing the requirements of a plastic material suitable for use in a service binocular.

The first prerequisite of a plastic to be used in a binocular is dimensional stability over long periods of time through wide variations of temperature and humidity and under severe weather conditions, to preclude distortion of the optical system. If the plastic is not dimensionally stable, difficulty will be encountered in maintaining the collimation and adjustment of the optical components. The dimensional distortion tolerances of the plastic materials control the relative positions of the optical axes, as well as the mechanical alignment of the binocular housing. Tolerances as close as 0.0003 in. must be maintained in machining critical dimensions of the molded body. These accuracies are necessary to maintain the optimum performance of the optical system and cannot be relaxed if the instrument is to meet service requirements.

The second important factor is the resistance to impact of the binocular made of plastic, which must be comparable to that of one made of an aluminum alloy. The plastic material must be both durable and resistant to shock to meet the severe requirements of service use.

The third important requirement is that the plastic material possess a coefficient of thermal expansion closely approximating that of the metal inserts used to secure the optical components and to provide additional structural strength. This matching of the coefficients of thermal expansion is necessary to maintain collimation and adjustment through varying temperatures and to prevent cracking or separation of the plastic material due to stresses induced by changes. The production of an acceptable and serviceable binocular of a thermosetting plastic was considered feasible, provided that metal inserts were properly incorporated into the plastic. All critical points of the plastic body must be strengthened and reinforced with inserts and proper support must be provided for the prisms, the eyepieces and the objective lenses. The relative dimensions and tolerances between the component inserts must be accurately maintained.

Selection of a plastic material

In order to determine which plastic might prove to be a satisfactory replacement for aluminum in the fabrication of

* The views expressed in this article are those of the authors and not necessarily those of the United States Navy.
** U. S. Naval Observatory.
† National Bureau of Standards.

binocular bodies, selected plastics were molded in a set of molds which were available at the Washington Navy Yard as a result of experimental work on this same problem conducted approximately 12 years ago. The physical properties of the plastic materials molded into 7 × 50 binocular bodies are tabulated in Table I.

Stabilization cycle—Subsequent to molding operations, the bodies which had been fabricated from various plastics were subjected to baking cycles as prescribed by their respective manufacturers in order to insure complete polymerization of the materials. Dimensional changes occurring during this stabilization cycle were measured at fifteen critical locations on the plastic binocular bodies prior to machining. The calculated percentage changes in dimension are reported in Table II. The slight distortion caused by the stabilization cycle on a binocular body fabricated from plastic A-2 will be approximately 0.16 percent. To allow for distortions caused by this stabilizing cycle and by mold shrinkage for a binocular housing $7^1/_2$ in. in width, it is necessary that all surfaces which are to be precision machined be molded with 0.005 to 0.010 in. of excess material as a machining allowance.

Effect of temperature variation—This test was conducted to determine whether the completed binoculars would exceed the maximum serviceable deviation of the optical axes as a result of temperature variations to be encountered in service. The 7 × 50 binoculars were collimated at 70° F., the temperature of the instrument was reduced to −40° F., and the change in optical alignment was measured and recorded as Test No. 1 on Fig. 1. The instrument was recollimated at 70° F., the temperature was raised to 140° F., and the change in optical alignment was measured and recorded as Test No. 2 on Fig. 1.

The plastic A-2 maintained the most satisfactory optical alignment of all of the plastics tested in the temperature range from −40 to 140° F. as shown in Fig. 1. The deviation in the optical alignment of this binocular is only 25 percent of the maximum allowable tolerance throughout the temperature range. These results indicate that all of the experimental plastic binoculars would perform satisfactorily under either arctic or tropical temperatures.

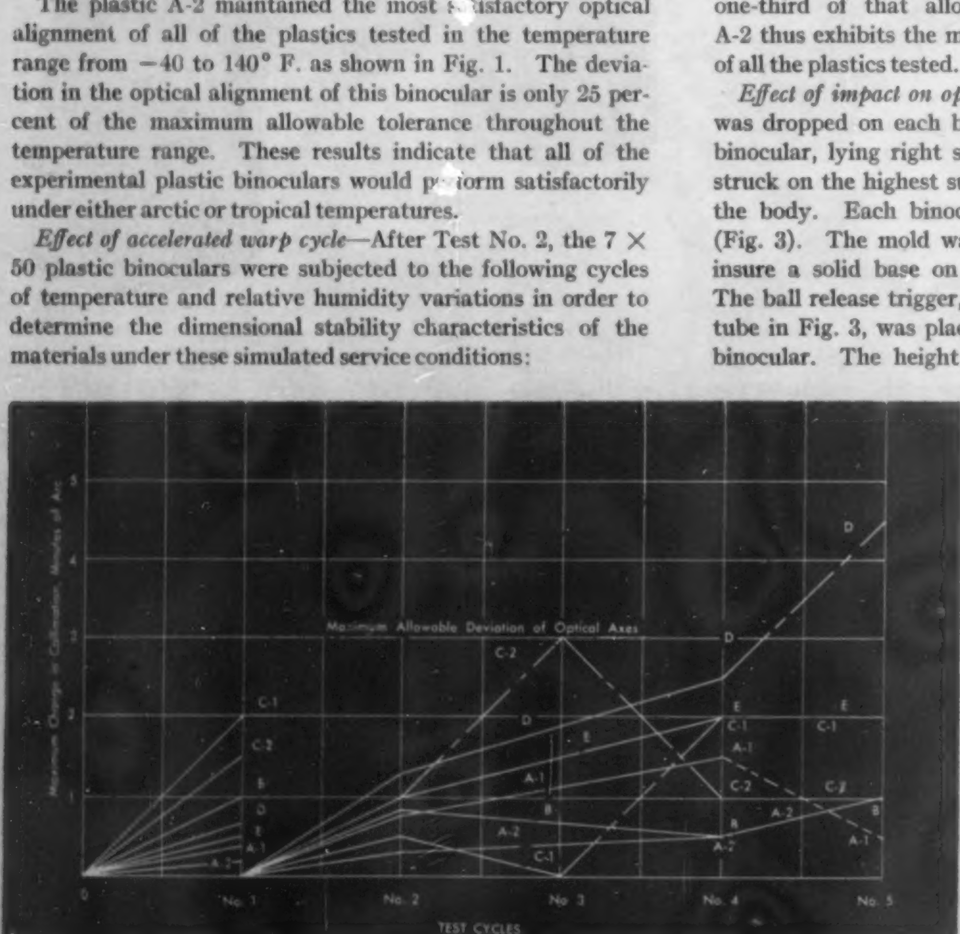
Effect of accelerated warp cycle—After Test No. 2, the 7 × 50 plastic binoculars were subjected to the following cycles of temperature and relative humidity variations in order to determine the dimensional stability characteristics of the materials under these simulated service conditions:

Test cycle	*Time*	*Temperature*	*Relative humidity*
	hr.	*° F.*	*percent*
Number 3	150	140	2–5
	16	140	70–75
	8	140	2–5
	16	140	70–75
	8	140	2–5
	16	140	70–75
	8	140	2–5
Number 4	24	140	95–100
	24	140	2–5
	8	140	95–100
	16	140	2–5
	8	140	95–100
	16	140	2–5
Number 5	17	−5	95–100
	23	140	95–100
	24	−10	95–100
	48	140	95–100
	17	−5	95–100
	26	140	95–100

The optical alignments, measured before and after each of the above tests, were checked on the equipment shown in Fig. 2. The maximum changes in optical alignment for each plastic formulation are recorded in minutes or arc of accumulated change under Tests Nos. 3, 4 and 5 on Fig. 1.

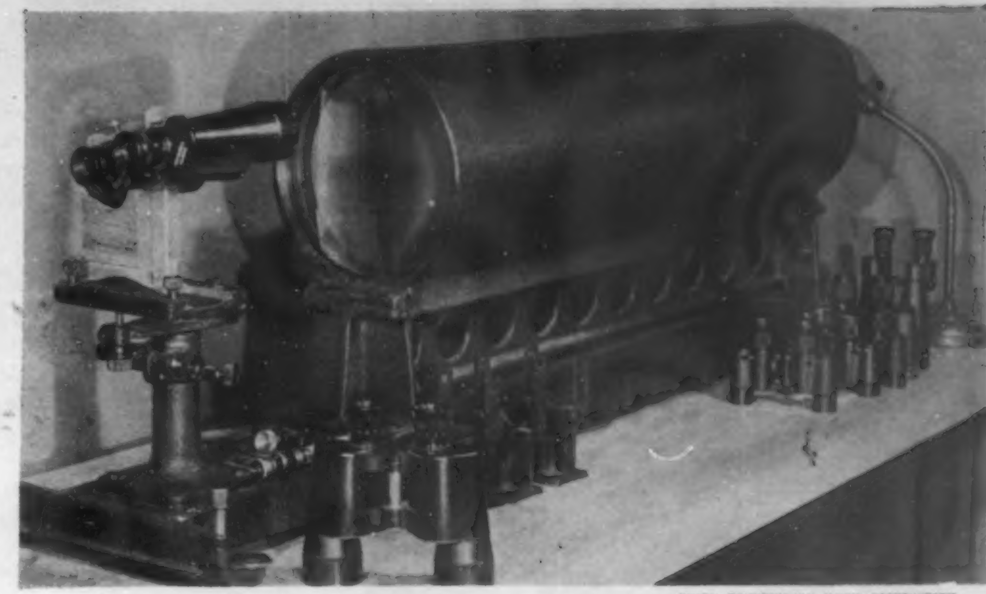
All of the plastic binoculars, with the exception of that fabricated from plastic D, maintained satisfactory optical alignment. The binocular fabricated from plastic material A-2 maintained its optical alignment with a deviation only one-third of that allowable in service. Plastic material A-2 thus exhibits the most satisfactory dimensional stability of all the plastics tested.

Effect of impact on optical alignment—A 130-gm. steel ball was dropped on each binocular at the same location. The binocular, lying right side up in a horizontal position, was struck on the highest surface 1 in. from the eyepiece end of the body. Each binocular was placed in a cement mold (Fig. 3). The mold was cast to fit the instrument and to insure a solid base on which to conduct the impact test. The ball release trigger, shown near the top of the dropping tube in Fig. 3, was placed first at a 10-in. height above the binocular. The height was increased in 5-in. steps to 40



1—***This chart shows the effect of the temperature variation and accelerated warp cycle upon the optical alignment of the binocular as ascertained by a series of five tests***

2—*A collimator used to check the assembled binocular subsequent to each service condition cycle, to establish a correlation between the dimensional changes and their effect on the optical alignment*



PHOTO, COURTESY U.S. NAVAL OBSERVATORY

in., then in 1-in. steps until failure occurred or until the maximum allowable deviation of the optical axes was reached. The maximum changes in optical alignment recorded at each step of the test are plotted on Fig. 4.

For comparison purposes, two standard aluminum binoculars were subjected to the impact test prescribed for the plastic binoculars. The changes in collimation were measured and are recorded in Fig. 4.

Standard aluminum binocular No. 2, when the optical alignment was checked subsequent to a 30-in. impact, exceeded the maximum serviceable deviation of the optical axes. The covering of the binocular fractured and broke under impact from a height of 46 inches. Standard aluminum binocular No. 1 exceeded the maximum serviceable deviation of the optical axes after a 30-in. impact, with a prism cracking under a 40-in. impact—thus rendering the instrument completely unserviceable. Plastic binocular C-1, which had only half the impact strength of the most stable plastic binocular (A-2) approached the maximum allowable deviation at impact from a height of 40 in. and did not fail until the body fractured under impact from 45 inches. The plastic binocular, utilizing this lowest impact material and wall thicknesses of $^5/_{32}$ to $^3/_{16}$ in., withstood 25 percent more impact than either of the aluminum binoculars before reaching maximum serviceable deviation of the optical axes.

Shock resistance of plastic binoculars—The assembled 7 × 50 binocular was attached by its axle to a strong cord suspended from the ceiling and was allowed to fall five times through a distance of 7 ft., the fall being sharply broken each time by the tautening of the cord. The binoculars were then disassembled and the inserts were inspected for fractures or separation at the junctures with the plastic.

Only slight changes in collimation occurred as a result of the shock tests. Inspection upon disassembly of the A-2 plastic binocular subsequent to the shock tests revealed that the inserts had remained securely in place in the plastic bodies, insuring permanent support at all critical points.

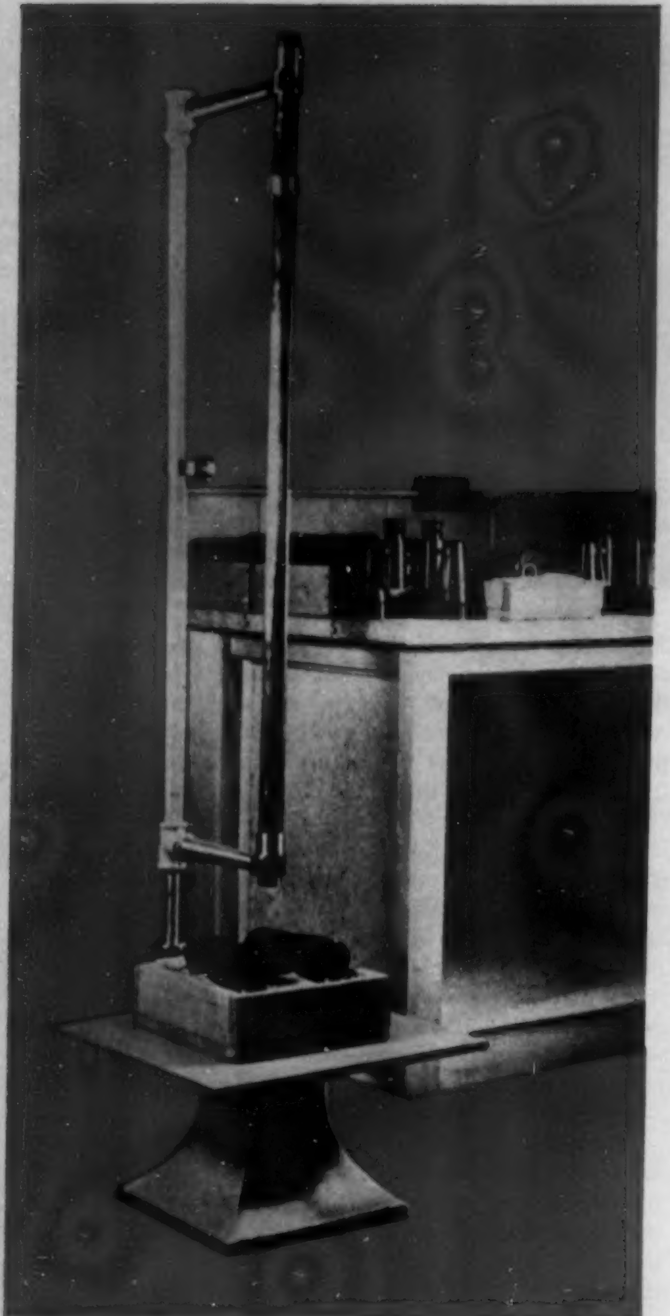
Plastic selected for the 6 × 42 binocular—The test results reveal that the material identified as plastic A-2 is by far the superior plastic formulation of those tested for use in binocular bodies. This thermosetting phenolic material, containing a long-fiber asbestos filler, is identified as Bakelite BM-15060.

Maximum dimensional stability is obtained by subjecting the plastic molding to a stabilization cycle subsequent to molding operations. The stabilization cycle consists of baking the material for 2 hr. at 150° F., raising the temperature to 225° F. in 1 hr., baking 2 hr. at 225° F., raising the temperature to 275° F. in 1 hr., baking 105 hr. at 275° F., and then cooling prior to removal from the oven.

The mean coefficient of linear thermal expansion of the plastic, subsequent to stabilization, is 17.0×10^{-6} per degree

TABLE I.—PHYSICAL PROPERTIES OF BINOCULAR BODY MATERIALS

Material	*Type of filler*	*Impact strength Izod, A.S.T.M. D256–43T*	*Tensile strength A.S.T.M. D651–42T*	*Specific gravity A.S.T.M. D792–44T*
		ft.-lb./in. of notch	*p.s.i.*	
Standard aluminum (12 percent silicon)	....	....	33,000	2.70
Phenolic plastic "A"				
1	Rag fiber and cotton flock	0.60	....	1.36
2	Long-fiber asbestos	1.00	6,000	1.89
Phenolic plastic "B"	Cellulose	0.55	5,500	1.44
Phenolic plastic "C"				
1	Long-fiber asbestos	0.54	7,300	1.35
2	Short-fiber asbestos	0.54	6,900	1.32
Phenolic plastic "D"	Rag (cellulose)	0.9	5,000	1.41
Phenolic plastic "E"	Cotton flock	0.55	7,900	1.37



PHOTO, COURTESY U.S. NAVAL OBSERVATORY

3—The effect of impact on the optical alignment of the binocular is determined by this ball dropping impaction apparatus which utilizes a 130-gram steel ball

C. over a temperature range from -30 to $30°$ C. and 17.7×10^{-6} per degree C. over a temperature range from 0 to $50°$ C.

Design of the 6 × 42 service binocular

A special binocular design was developed in order to utilize fully the advantages offered by the plastic material. The current needs for an all-purpose service binocular were taken into consideration in the production of this design, and the following requirements were among those considered:

a. A binocular adaptable to night use, similar in field and light-gathering power to the standard Navy 7 × 50 binocular.

b. A relatively light instrument comparable in weight to the standard 6 × 30 binocular.

c. A durable and rugged binocular embodying a fixed focus and fixed interpupillary distance which thereby eliminates the necessity for axial and eyepiece adjustments and makes the binocular especially suited to amphibious operations and night fighting.

d. A waterproof binocular capable of maintaining its watertight integrity under severe service conditions of extremes of pressure and temperature.

e. A fungusproof binocular which will remain unaffected by microscopic organisms, particularly types indigenous to tropical areas

f. A compact binocular containing a minimum number of intricate parts and lending itself readily to mass production.

g. A binocular whose embossed gripping surface is an integral part of the molded structure—thereby eliminating the necessity for a separate covering material.

h. A binocular which is fabricated from corrosion-resistant materials.

Optical design—Calculation of an efficient optical system for the service binocular was governed by requirements for an optical system similar in field to the Navy 6 × 30 binocular and approximating the light-gathering power of the standard Navy 7 × 50 binocular; an optical system the component parts of which could be adapted to a compact, light-weight, moldable body design; and an arrangement of optical elements to obtain an unusually wide distance between the objective lenses and to increase the stereoscopic effect, making the binocular an excellent spotting instrument. It was concluded that calculations for a lens system based on a 6-power magnification and a 42-mm. entrance pupil, utilizing standard Zeiss 7 × 50 binocular prisms, would most satisfactorily and efficiently fulfill all service requirements. The optical and weight characteristics of the 6 × 42 binocular as compared with typical 6 × 30 and 7 × 50 binoculars are as follows:

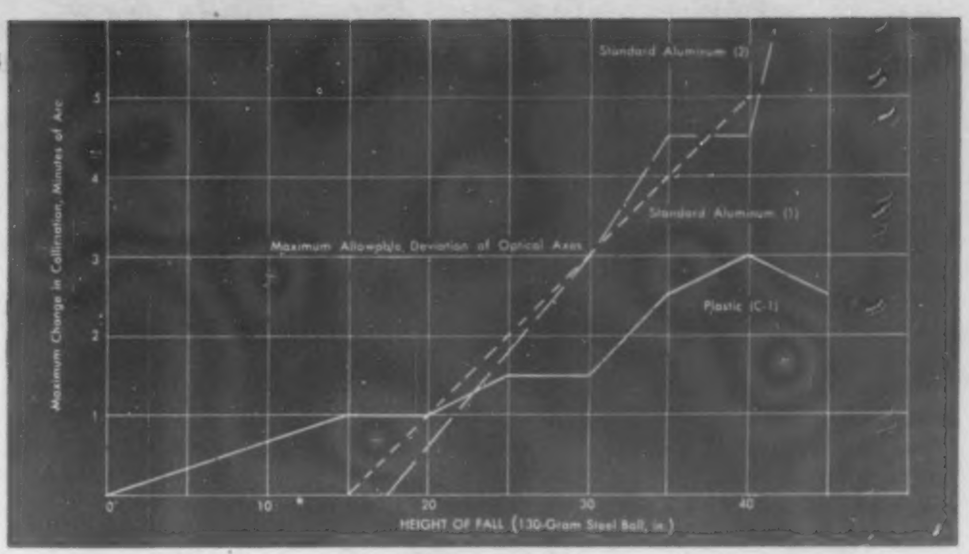
Characteristics	*6 × 30*	*6 × 42*	*7 × 50*
Magnification	6	6	7
Entrance pupil, mm.	30	42	50
Exit pupil, mm.	5.00	7.00	7.14
Eye relief, mm.	11.3	10.7	14.5
True field	8° 54′	8° 30′	7° 39′
Weight, oz.	22	36	44

The optical design incorporated a fixed interpupillary distance which eliminated the necessity for interpupillary adjustment prior to use. The maintenance of optical alignment is

TABLE II.—DIMENSIONAL CHANGES DURING STABILIZATION TREATMENT

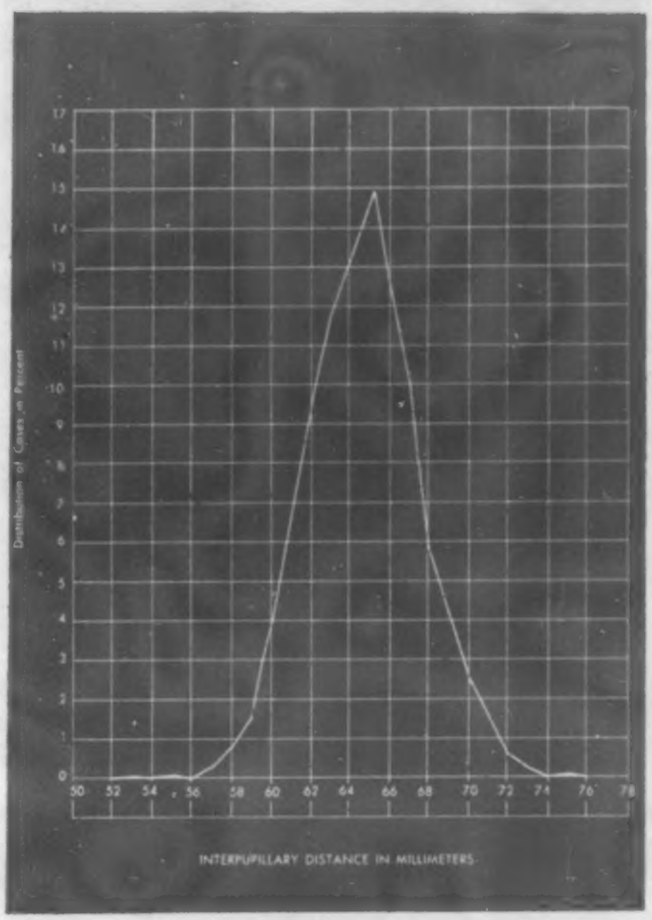
Material	*Baking stabilization treatment* — *Temperature*	*Time*	*Relative total*	*Change in dimension, average*
	° F.	*hr.*	*° F. × hr.*	*percent*
Plastic "A"				
1	150	2		
	150–225	1		
	225	2		
	225–275	1		
	275	105	30,063	0.54
2	150	2		
	150–225	1		
	225	2		
	225–275	1		
	275	105	30,063	0.16
Plastic "B"	280	6	1,680	0.47
Plastic "C"				
1	300	4	1,200	0.18
2	300	4	1,200	0.11
Plastic "D"	275	8	2,200	0.26
Plastic "E"	200	3	600	0.04

4



4—Graphic results of tests made to determine the effect of impact on optical alignment. 5—Interpupillary distance distribution given in millimeters

5



greatly facilitated by the elimination of hinged binocular bodies. The value adopted for the fixed interpupillary distance was determined on the basis of the frequency curve shown in Fig. 5. Although the greatest frequency lies at approximately 65 mm., it was concluded that binoculars might well be produced in three sizes with interpupillary distances of 62, 65 and 68 millimeters. This range would provide perfect accommodation for approximately 87 percent of all service binocular users—this figure being based on a maximum pupil decentration of 0.75 millimeter. The maximum decentration would require a divergence of the eyes of 5 min. if the axes of the two telescopes were parallel, this divergence angle being derived from a development of the following formula:

$$\text{Divergence angle in radians} = 2 \times \frac{\text{Decentration (mm.)}}{\text{Image distance (mm.)}}$$

Since it is more difficult to compensate for divergence than for convergence, the axes of the two telescopes should be inclined to each other at an angle of 1.0 min. in the horizontal plane, converging behind the observer. This would cause the lines of sight for an observer with correct interpupillary separation to converge in front of the observer at an angle of 5 minutes.

Details of the eyepiece and objective optical systems are shown in Figs. 6 and 7. The eyepiece design does not allow for adjustment in focus by the observer, but it may be set by an optical repair shop. A center-field diopter setting of -1.2, equivalent to a focal image distance of 0.85 meter, was adopted as being a comfortable range for normal eye accommodation.

In the design of the 6 × 42 binocular optical system, a compromise between curvature of the field and astigmatism was necessary. It was considered that partial flattening of the field, with the astigmatism so corrected as to give excellent imagery over an apparent field of about 25°, was preferable to complete flattening of the field with a smaller area of excellent imagery. Since the curvature is not completely corrected, an accommodation of approximately one diopter is necessary when changing from viewing the center of the field to viewing the edge of the field. An accommodation of this amount can easily be made by the average observer. The instrument is well adapted to night use, as the light-gathering properties are good and the 7-mm. exit pupil utilizes the pupil of the dark-adapted eye to best advantage.

Structure design—To accommodate the 6 × 42 optical system, the binocular body was designed to be molded in two pieces as shown in Fig. 6. The two eyepiece housings shown in Fig. 6 are also molded of Bakelite BM-15060. Metal inserts were incorporated at all vital points (Fig. 8).

In order to eliminate the possibility of cracking the plastic or loosening the inserts which retain the optical elements, it was necessary to obtain for the inserts an alloy whose coefficient of thermal expansion closely approximates that of the phenolic material. Since lightness is of paramount importance, lightweight alloys were the only materials considered for this application. Linear thermal-expansion determinations were made on several special low-expansion-type alloys processed by powder metallurgy, forging, permanent molding and die casting. A die-cast aluminum-silicon alloy, with a coefficient of thermal expansion of 18.5 ×

10^{-6} per degree C. over a temperature range from −30 to 30° C., was found to be suitable. Its coefficient most closely approximates that of the phenolic material chosen for binocular body fabrication. This die-cast material was also considered more suitable than the other types of alloys from the standpoint of fabrication, since extremely close mold tolerances could be maintained—a condition which eliminated the necessity for extensive machining operations.

In order to obtain a binocular body with impact resistance and dimensional stability comparable to that of aluminum, while maintaining the weight as small as possible, the body walls are graded in thickness from $^{3}/_{32}$ in. at the outer extremities to approximately $^{5}/_{32}$ in. in the central portion between the eyepieces. The plastic body is also reinforced at several points in order to provide sufficient material to hold the metal inserts firmly. The eyepiece caps are designed to accommodate standard eyepiece filters.

PHOTOS, COURTESY U. S. NAVAL OBSERVATORY

8

Production and evaluation of the binocular

Upon completion of the design for the 6 × 42 binocular, molds for the plastic parts were fabricated by the Plastics Divisions of General Electric Co. Production samples were submitted to the Naval Observatory in February 1944. Optical systems were assembled, and the completed instruments were subjected to optical analysis and simulated service-condition tests in order to determine their practicability for Navy use.

A complete analysis of the optical system is contained in Table III. In general, the results of the optical analysis indicate satisfactory optical performance. The only adverse characteristics noted are those associated with slight spherical aberrations apparently caused by the objective lenses. A consequent small loss in resolving power is noted, but not enough to impair the serviceability of the instrument. The slight defects noted could be eliminated by a slight modification of the optical design. The optical performance, however, is considered adequate to fulfill completely the service requirements for which the instrument is intended.

Procedures for the structural analysis of the plastic binocular closely parallel the procedures for structural analysis as applied to the 7 × 50 molded binocular bodies in the preliminary investigation of the plastic materials. However, certain variations and additions were incorporated into the test procedures in order to evaluate properly the effectiveness of the completed design.

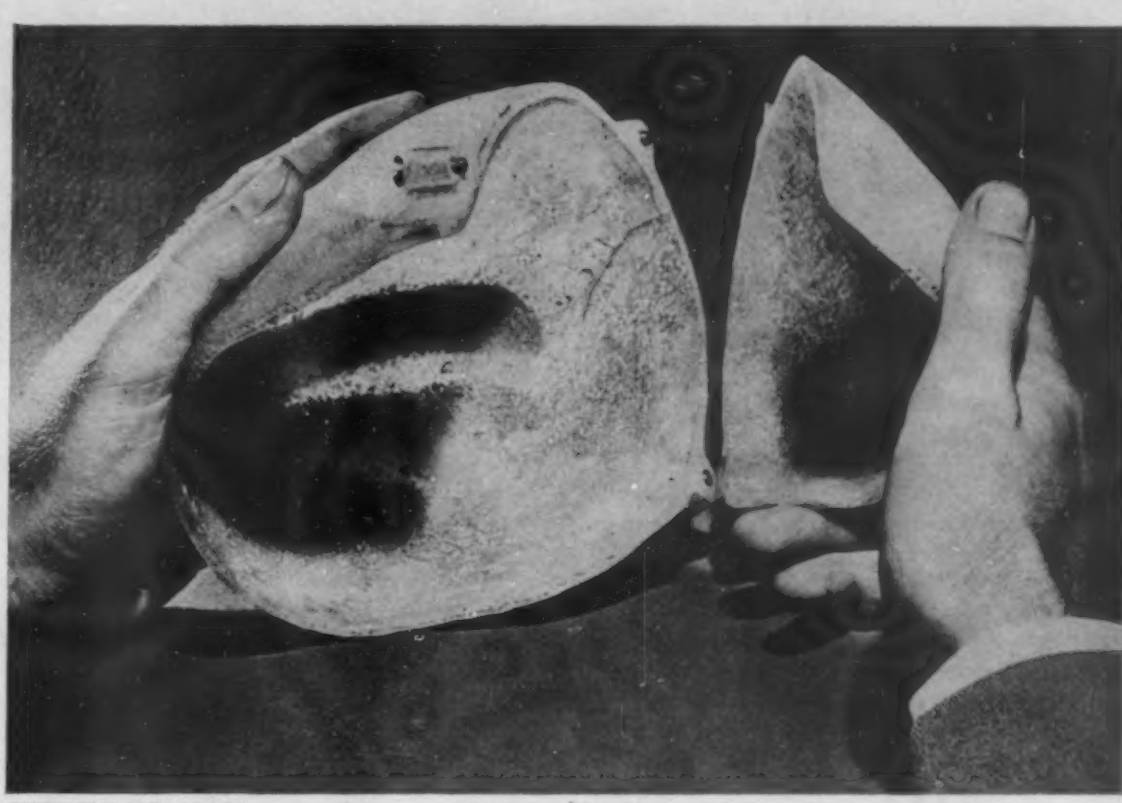
Accelerated service-condition test—An assembled binocular and an unassembled binocular body were subjected to a series of moderate and extreme accelerated service-condition cycles as shown in Table IV. Subsequent to the completion of each cycle, five dimensions of the eyepiece housing and ten dimensions of the objective housing were measured in order to provide for a dimensional-stability study of the binocular material in this final molded design. The collimation of the assembled binocular (*Please turn to page 198*)

6—The binocular disassembled to show each part of the prism assembly and eyepiece details. 7—For greater clarity, the prism has been subassembled so that the objective optical system can readily be visualized. 8—These metal inserts were incorporated at all vital points

6

7

ACRYLIC for SURGERY



PHOTO, COURTESY ROHM & HAAS CO.

This rigid acrylic plastic head cap proved to be an effective corrective for hydrocephalus, or excessive head growth, in the case of a 5-month-old child

THE remarkable, often spectacular, plastic reconstruction work being performed by the medical profession on our wounded veterans has had a tendency to obscure other developments in the use of plastics for the alleviation of human suffering. One particularly interesting application of acrylic plastics is a rigid head cap used as a corrective in the case of a five-month-old baby whose excessive head growth was diagnosed by specialists as hydrocephalus.

According to general information, hydrocephalus is caused by an excess of fluid beneath the skull. This excess fluid may be caused by the partial or complete closure of communication between the skull and the spinal cavity. The resultant enlargement of the skull is quite pronounced and extends in many cases from above the eyes to the top of the neck, and from ear to ear.

Consideration of means other than surgical for controlling the abnormal head growth of this young child brought to mind the practice of certain African tribes and American Indians of deforming the skull by mechanical means. Their primitive use of tape, cord or wood to elongate, flatten or otherwise shape the skull suggested the use of a rigid head cap which would fit this child's head.

The theory behind the use of such a skull cap was that if there were a stoppage, complete or incomplete, through the ventricles to the spinal cavity, the pressure of the fluid would be exerted against the constriction rather than toward the bones of the skull. If no communication with the spinal cavity existed, an unnatural opening might be effected which, in time, might become permanent.

The first step in the forming of this rigid acrylic plastic head cap was the construction of a wire-reinforced plaster of Paris tray in which a mold of the head could be taken using hydro-colloid impression material. To allow for existing undercuts, the tray was made in two sections. Following the pouring of a stone model, a $^1/_4$-in. thick wax head cap was built up. The screws needed to hold the finished acrylic plastic cap in place on the child's head were imbedded in this wax model. A flask was then constructed from a wooden box and the wax head cap invested therein. Because of the difficulties of proper flasking, no attempt was made to retain in the final plastic cap the clear optical properties characteristic of the acrylic plastic.

Prior to the placement of the cap, the baby's head increased at the rate of $^1/_2$ in. in circumference each week, and by the time the head cap was first applied it measured 17 in. in diameter. Due to the increase in the size of the head that occurred while the cap was being made, the screws could not be completely tightened when the head form was first fastened into place. However, little by little, the screws were tightened until, at the end of three days, the cap entirely enclosed the baby's head. No discomfort was apparent and the child seemed entirely happy.

At the end of the first week the acrylic plastic cap was removed and the head measured. Although the cap was off less than one hour it could not be completely tightened when replaced and the screws could not subsequently be completely taken up. During the next four weeks the cap remained on the head, measurements revealed only a slight increase in the circumference of the skull and again the child seemed to experience no irritation. For further observation the cap was left off for 24 hours—and in this time there was a $^1/_2$-in. increase in size. Since (*Please turn to page 196*)

On the surface

by EUGENE MORLEY*

"THE surrey with the fringe on top" was made of wood and had to be painted to protect it against the weather. It had to be decorated, too, to please a generation that liked fringe. To meet these demands, coach colors were developed that had no equal—hard and durable, and capable of retaining a high polish. When, later, the motor car, made of metal and vibrating at a rate something in excess of a fast trot, would have none of these coach paints, coatings were developed which were designed to adhere to metal and to vibrate with it without damage.

Now we are told that the age of plastics is approaching. It's a little late to make a plastic surrey, and we may or may not make the mudguards of our postwar motor cars of plastics. But we will make a lot of things of plastics and it's time to think of coatings—a little about protective coatings and a lot about decorative ones.

In contemplating postwar uses of plastics, we tend to stop our thinking at a consideration of their inherent characteristics. Their resistance to solvents, to weathering, to abrasion, etc., is not surface deep—it's inherent. Color, if it is there, is inherent. These are wonderful qualities and wonderfully controllable. A recent article, "The Ups and Downs of Color,"[1] treated this subject very thoroughly. Our intention here is not to quarrel with this article, but rather to endorse it and to continue from that point.

The writer holds with the more progressive of our designers that it is better for color to be integral than to be skin deep. Yet we know, too, that decoration is necessary and that trade name identification is necessary. If our dishes are soon going to be of plastics, not all will be of plain, though well-chosen, colors; some will have applied decorations. If we are going to see new containers made of plastics, we know that all of them are going to be labeled and that some are going to be decorated. The question of what should be decorated and what should not is one for the designers. I don't want a multicolored design of Sweet William plastered over the dashboard of the motor car I'm thinking of, but a simple, opaque motif might interrupt the unbroken transparency of my acrylic coffee table, and a simple decoration applied to the polystyrene glasses I shall set on that table might help me differentiate them when I take them to be filled.

Let's not limit ourselves to a transparent world, or to one in which every colored article can have only one color. Additional colors can be molded-in with some success, but at considerable added molding expense. For years we've been molding in debossed trade marks and calibrations and wiping in color by a hand operation. For some recent war items where added color was necessary, it was found possible to insert a compression-molded shape into an injection mold with the result that the final molded article had more than one color—and required more than one molding operation.

Applied colors are something else, however. War uses of imprinting, and war restrictions on metals for civilian uses have resulted in developments in the decoration of plastics which should be noted now by our designers and our manufacturers. An interesting instance is the experience of the cosmetic trade with plastic lipstick containers. After the panic over the complete restriction of metal for this item had subsided and it had been shown that plastics were going to come to the rescue, the entire field was faced with the prospects of using scarcely more than half a dozen different molds for 300 to 500 different brands of lipstick. Decoration was a must! First, for identification, and second, to marry the new containers to already established lines.

Most of these containers were decorated by the silk-screen process. The enamels and lacquers familiar to the silk-screen trade were used confidently and seemed to be satisfactory at first. However, it had not been anticipated that the particular plastic used for these lipstick cases was one in which the plasticizer tended to respond to weather changes and to show a greater affinity for the paint or lacquer than for the plastic. The result was that the first warm, humid days saw otherwise perfect applications transformed into something resembling a good grade of chewing gum. I'm afraid that a few thousand lipsticks reached the retail market two years ago carrying decorations and trade names that were almost magically fugitive.

A search was immediately made for a means of solving this problem, and decorating materials and methods were evolved which seem to hint at a bright new field in coatings. The development of special materials for the coating and decorating of fabricated or molded plastic articles should become as exciting as was the development of special coatings for metals several years ago.

At first, a sealing material was tried which resisted the plasticizer exudation and which was not unfriendly to the application of the silk-screened enamel. The result was permanent enough, but it required two operations and altered the surface of the plastic in a way that was undesirable. Surface coatings of nitrocellulose lacquers were applied over printing and plastic alike, but the entire surface was then subject to deterioration from exudation. Finally, a cellulose acetate base lacquer was devised which, when sprayed over the printing, rendered it impervious to the action of the migratory plasticizer. Later, characteristics of the sprayed coat and the printing material were combined to give a printing ink which would stand up without further coating.

An unexpected feature of this printing ink was its similarity in surface to the plastic itself. It showed characteristics that were completely unfamiliar to silk-screen firms long accustomed to the use of lacquer and enamel. In the first place, no "raised" or "embossed" quality was apparent. The ink seemed to sink below the surface of the plastic as though inlaid. The solvent was quickly removed from the application substance by its affinity for the molded plastic. The application was set within 10 seconds, completely dry within 10 minutes! Upon drying, it proved completely irremovable except where such damage was inflicted that the actual surface of the plastic itself was removed.

Further experiments showed that this solvent-carried application of a plastic substance to plastic, when dry and hard, responded to finishing in precisely the same manner as the surface of the plastic itself. Light buffing or tumbling with a delicate abrasive or polishing material quickly reduces the

* Creative Printmakers Group.
[1] MODERN PLASTICS 21, 81–8 (May 1944).

Familiar brands of lipstick, face powder and rouge are now attractively housed in surface-decorated plastic containers. The applied coloring, itself a plastic substance, has a natural affinity for the surface and won't rub off

somewhat matte surface of the application to a sheen precisely similar to that of cellulose acetate. At least one silk-screen firm learned an embarrassing and costly lesson. Since the difficulties have been overcome, milady's imprinted shade label no longer loses itself amid the paraphernalia of her purse.

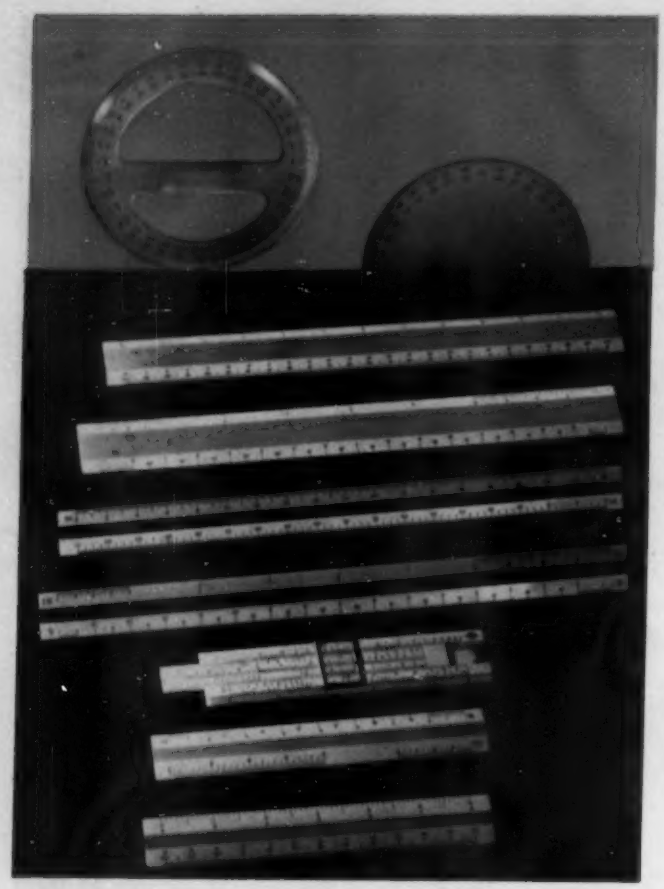
This story, although its significance is accentuated somewhat by the emergency condition which obtained, should open our eyes to the fact that the "superficial" decoration of molded articles is one with which we shall soon deal on an increasing scale as the use of plastics in new fields increases.

The same spraying and decorating substance, altered only slightly from case to case, is applicable to cellulose acetate and acetate butyrate, to acrylics and to the vinyls with the same results. In its simplest form, it lends itself easily to silk-screen application. In diluted form, with slight alteration, it presents no difficulty when used as a spraying medium. However, alteration in substance must be made to achieve the proper viscosity for rubber-die and letterpress printing.

Substances are already available which have been specially designed for the coating and decoration of various plastic materials. Different coatings, of course, for different plastics. Acrylics and acetates, since they have common solvents, can be treated as a group particularly adapted to superficial coating and decoration. The application of paint, enamel, lacquer, or any of these substances could only hope to form a superficial bond which would be inhibited by the slick surface of the plastic and would be subject to a reaction to any cold flow that might be set up. However, a prepared substance containing a solvent for the plastic, if properly balanced and adjusted for the printing or spraying process involved, can achieve much more because it can depend on the phenomenon of cohesion, rather than adhesion, for its endurance. Interesting experiments which are conclusive enough but not yet comprehensive have been made with coatings designed for polystyrene. The solubility of molded polystyrene offers at least an equal prospect for such completely successful decoration and coating as those described above for acetates and acrylics. In view of the prospective use of polystrene in postwar products, the experiments with this type of coating promise to be more important than any yet described.

The advantages of coating and decorating material of this sort are that they bond themselves permanently to the plastic and that, being similar in composition to the plastic, they do not have an "applied" appearance. In decorating metal it is often necessary to cover the entire surface, but due to the similarity in surface this is not necessary with plastics. Due to the fact that the application material invariably contains a solvent which attacks the plastic, a durable bond is formed without any baking.

Since the durability of the bond (*Please turn to page 196*)



Accurate drafting instruments

Postwar engineers and architects will work with accurate, precise drafting instruments injection molded of thermoplastic materials. These scales, slide rules and protractors, now used in war production, retain their accuracy of calibration under most strenuous usage

OF ALL the shortages that, at one time or another, have developed in the war production program, one of the least publicized yet most critical has been in drafting instruments. Scales, slide rules, protractors and other instruments have been needed, and needed in almost unbelievable quantities, by engineers and architects in the Army, Navy, Air Forces and in the war industries. Old methods of production were found to be grossly inadequate for supplying these instruments in needed quantity and satisfactory quality.

A typical example is the common triangular relief facet scales used, with different calibrations, by all engineers and architects. These scales had been made principally of boxwood. But there was not enough boxwood and, moreover, it was necessary to season it for two years before using.

If celluloid faces were to be laminated to the boxwood, another twelve months were required for the celluloid to set properly. Then it was a slow process to stamp on the figures and divide lines which sometimes number into the hundreds. This was usually done by a machine taking 48 units at a time, with the result that it required 12 hours to do a complete job on that quantity.

Leading manufacturers of drafting instruments finally turned to molded thermoplastics for the answer to the entire problem, but only after they were finally convinced that the desired accuracy and precision could be obtained in the multiplicity of division lines and in the many figures that were necessary. As a result, triangular relief facets now are being turned out by injection molding complete with all lines and numbering, fully normalized and ready for use in just 24 hours, as compared with the two or three years required to produce in finished form the boxwood or celluloid-faced boxwood scales.

A midwest molder is now turning out slide rules, flat four-bevel engineering and architectural scales, half round protractors, full round cut-out beveled protractors and similar instruments by the same process and to the same exacting tolerances. It is believed that these products, presently used in quantities by the Armed Services, Government agencies and war industries, and also on sale in the retail market, represent a new advance in the accuracy and precision possible with plastics molding; and that they will be an important contribution to the postwar engineering and architectural fields.

Biggest of the problems encountered was to achieve the desired accuracy in the engraved dies, and in the beginning the molding company sought to have the dies made by outside engraving houses. Specifications called for the dividing lines to be not in excess of four thousandths of an inch wide and a minimum of five thousandths in depth, but the best results that could be obtained in the test dies were lines measuring ten thousandths wide by five thousandths deep.

In the end, the company installed its own engraving department, and after long experimentation with equipment and methods, succeeded in getting the dividing lines down to three thousandths of an inch wide. They also found it possible to make the lines deeper than they are wide. This extra depth—up to five thousandths—is especially desirable when it comes to wiping in the color.

The triangular scales, molded of acrylic resin, have divisions as fine as 60 to the inch. The calibrations on the 6 faces of the scale for engineers are in tenths, twentieths, thirtieths, fortieths, fiftieths and sixtieths of an inch. For the architects, graduations are as follows: a full size, divided to sixteenths of an inch, a three inch per foot, $1\frac{1}{2}$ in., 1 in., $\frac{1}{2}$ in., $\frac{3}{4}$ in., $\frac{3}{8}$ in., $\frac{3}{16}$ in., $\frac{3}{32}$ in., $\frac{1}{4}$ in. and $\frac{1}{8}$ in., all per foot with sub-divisions for some scales as small as $\frac{1}{64}$ inch.

Probably the most intricate of the new plastic drafting instruments are the slide rules. A 5-in. pocket size, now in full production, is the first slide rule of this size ever molded with complete divisions and numerals, according to the molder. Output of 10-in. standard size rules also has been begun. Both rules are adjustable with screws on the back regulating the tension of movement of the slide—the first time a 5-in. rule has been made with this feature. The 5-in. rule is molded of polystyrene and acrylic, while the 10-in. type is wholly of acrylic.

The dividing lines on the slide rules are three to three and one-half thousandths of an inch (*Please turn to page 194*)

Aladdin's lamp

CENTURIES ago there existed a truly wonderful lamp. We are told that when the lamp was rubbed, a genie appeared who would carry out the rubber's wish. The modern version of this Arabian Nights' fantasy is a gleaming white bathroom fixture which, when turned on, gratifies man's wish for a perfect shaving light.

The lamp is compression molded in two parts—a base and a shade—and assembled by means of molded lugs on the shade which fit into corresponding slots molded into the base. Due to the size of the pieces, single cavity molds are used. The material selected is white translucent urea, standard for most electrical reflector work due to its ability to produce a soft, warm light. The base and shade together weigh approximately one pound.

Molding conditions must be carefully watched because any gas marks, streaks or blisters present show up as defects in the finished pieces. The shade is molded on a $2\frac{3}{4}$-min. cycle on a fully automatic press. Powder, which is used rather than preforms to avoid weld lines on the surface, is preheated, then loaded into the mold. The press operator starts the cycle by pushing the starter button. At the end of the cycle, the mold automatically opens and the part is removed (see Fig. 2). When the mold has been cleaned of flash, a new charge of powder is introduced and another cycle started. During the cycle, the press operator has time to remove flash from the molded article with a flat, single cut, hand file. Shades are then carefully telescoped into a tote box.

The base is molded in a similar manner, but on a slightly longer cycle because it contains thicker sections than the shade. Flash is removed at the press by the operator before the parts are carefully stacked and delivered to the assembly line.

A completely assembled lamp consists of the two molded parts plus fourteen miscellaneous accessories. The base begins its travels at the extreme right, the shade at the extreme left of the assembly line, and both pieces work toward the center of the line where the unit is completed and then removed.

1

2

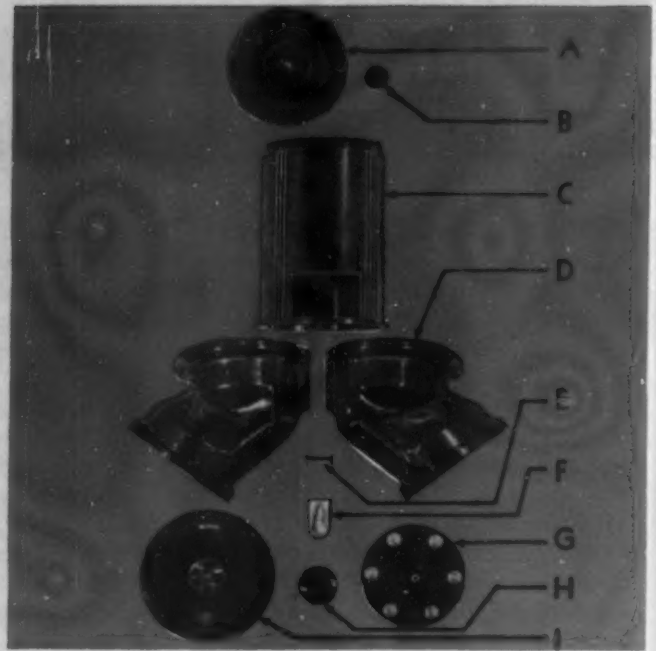
PHOTOS 2 & 3, COURTESY AMERICAN CYANAMID CO.

3

1—This shaving lamp concentrates light where it is most needed. 2—At the end of the molding cycle, the mold automatically opens and the part is removed. 3—The press operator removes flash from a completed part with a file

The first step in the assembly of the base is to place it in a holding jig and insert the electric socket and chain through a hole provided for that purpose. The socket protrudes through the hole and is secured (*Please turn to page 188*)

2



1

3

PLASTICS

WHILE THE AVERAGE WHITE-COLLAR WORKER or housewife uses salt tablets only at the height of a summer's heat wave, workers in industry find the tablets a year-round necessity. This sodium chloride tablet unit (Fig. 2) was developed to meet the need for an economical dispenser which would provide protection against moisture and dust, resist salt corrosion and stand up under hard usage.

Except for connecting screws and eyelets, this dispenser is made entirely of plastic. Two of its eleven parts are of methyl methacrylate and nine of molded wood-flour filled phenolic. All parts except the hopper window are shown in Fig. 1. The cover (*A*) is recessed on the inside to fit snugly over the hopper body (*C*), to exclude moisture. A knob (*B*) conceals the locking device. Although the base (*D*) is molded in two parts, the halves are joined so snugly as to appear as one. The screw eyelet (*E*) holds these two base sections together. The interior ribs guide the tablets into the apertures of the dispensing disk (*G*), which is so designed that one-sixth of a turn on the knob (*H*) releases a tablet. The spout of this dispenser is molded integrally with the bottom cover (*I*) and covered with a transparent lid (*F*).

Credits—Material: Bakelite and Lucite. Molded by Chicago Molded Products Corp. for Standard Safety Equipment Co.

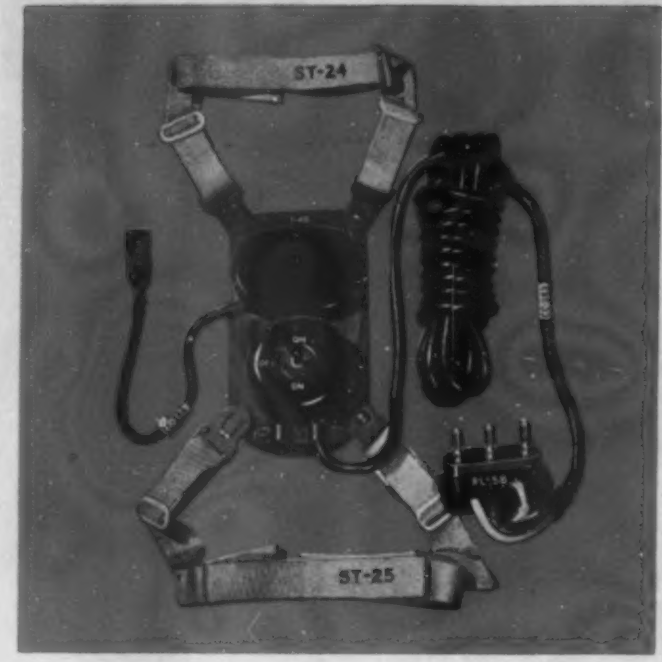
TWO NEWLY-DEVELOPED TEXTILE TREATING processes which grew out of research to improve GI fabrics seem destined to have a profound effect on the postwar textile industry. One method is said to make woolens shrinkproof (girl at right, Fig. 3), wrinkle-resistant and more durable while the other is described as rendering cotton, rayon and wool water-repellent. Melamine is used in both processes.

According to company reports, neither process alters or impairs the original and desirable qualities of the basic fibers. When applied in proper formulations, the chemical treatments are described as leaving the appearance and feel of the textiles either unchanged or benefited.

The process for imparting water-repellent qualities to cotton involves external treatment of fibers by a modified thermosetting melamine. It is applied from a water solution on a standard textile padder, then cured several minutes at 265 to 270° F. When cured it forms a waterproof film bound tightly to individual fibers.

On the other hand, in the process for making woolens shrinkproof, individual fibers are impregnated with a tough heat-, water- and chemical-resistant melamine. While the process' greatest possibilities are seen in wool, it is also effective on cotton, rayon, linen and aralac. The yarn or fabric is passed through a water solution of the melamine compound and cured for several minutes at about 275° F.

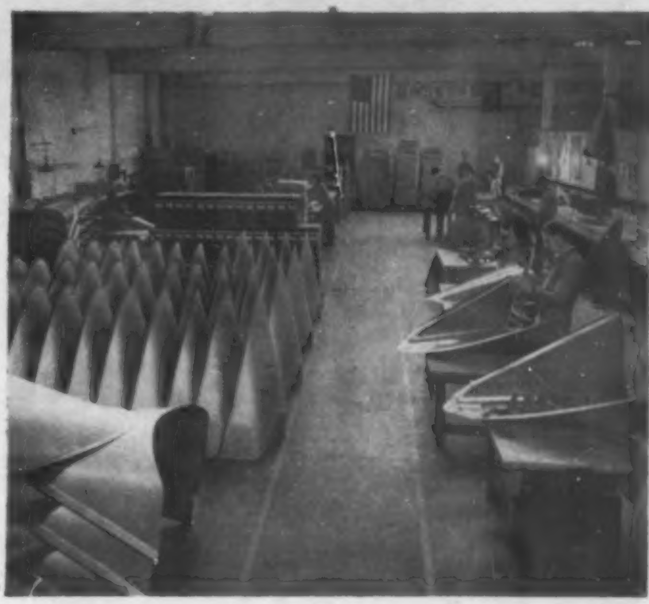
Credits—Material: Monsanto melamine. Shrinkproof process called Reslooming. Both processes by Monsanto Chemical Co.



4

5

PRODUCTS*



6

THE FINEST LIP MICROPHONE OR TRANSMITTER is useless if the equipment connecting the two elements is faulty. To achieve the high standard of performance necessary in communication equipment used by our Armed Forces, the U. S. Signal Corps has adopted this chest set (Fig. 4) which contains 5 plastic parts. The assembled set consists of a chest unit equipped with a switch, a junction box, two cotton webbing straps, and two cords with terminal connections for connecting a throat or a lip mike to a transmitter.

Both the switch, which consists of a phenolic base and a housing, and the junction box are located on a chest plate which is held in place by the webbed straps. The body of the switch is produced in a 12-cavity transfer mold of high-impact plastic material. The weight per piece is 6 grams. The toggle switch employed in this part has three positions—on, off and momentarily on. The molded phenolic junction box is positioned directly above the switch.

The cord which connects with the microphone is a two-conductor stranded copper wire with a jack, or shell, at the outer end. These cellulose acetate butyrate shells are molded in 8-cavity dies—each cavity representing one-half of the completed part. The second connecting wire, a 3-conductor cord, is plugged into the transmitter by a phenolic plug.

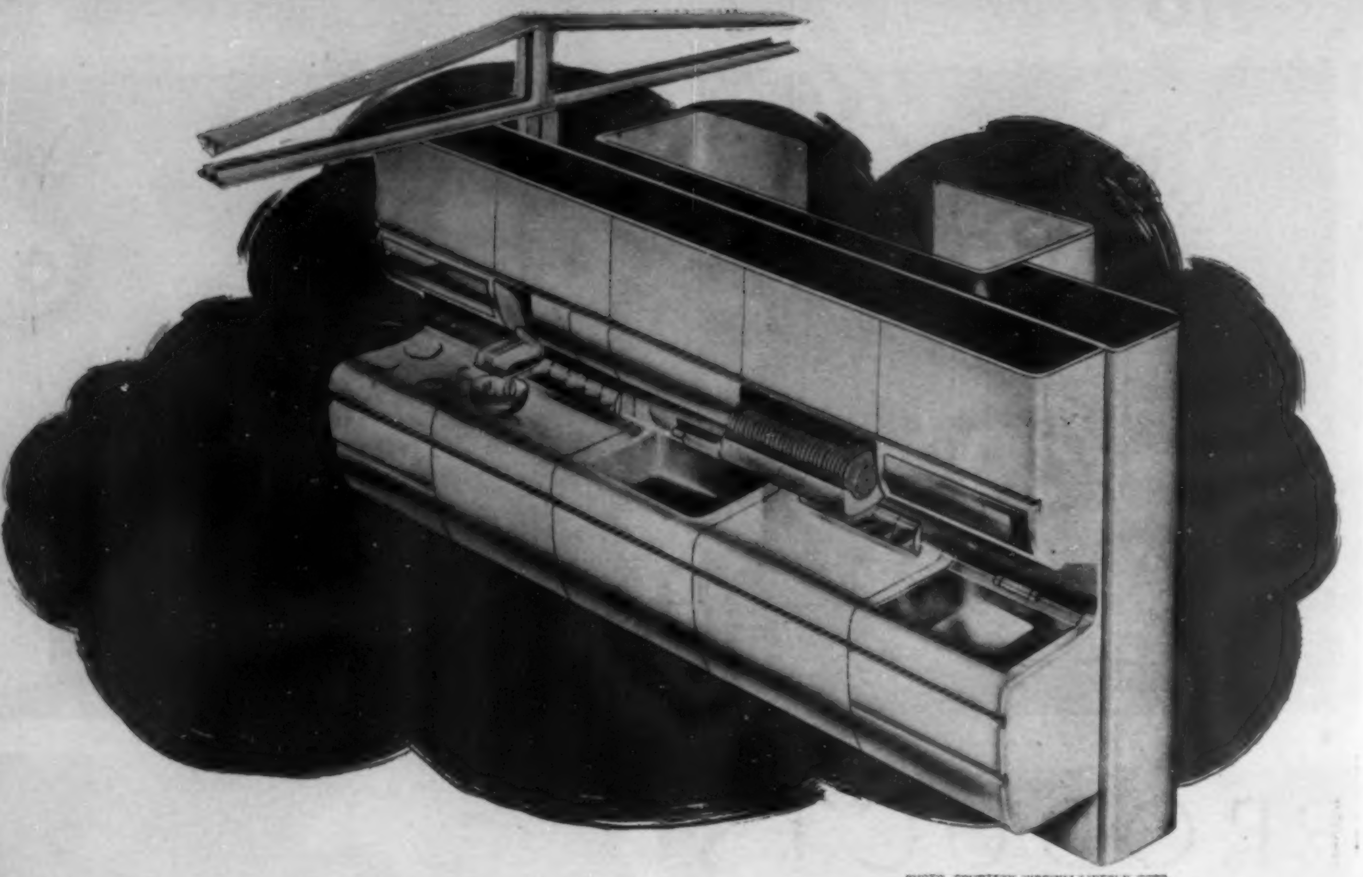
Credits—Materials: Bakelite, Insurok, Tenite II. Switch base, PL-58 plug and junction box molded by Reynolds Molded Plastics Div., Continental Can Co.; Switch housing by Richardson Co. and Molded Products Co.; JK-48 shells by American Molded Products Co.; for Trav-Ler Karenola Radio and Television Corp.

TYPICAL OF THE LARGE PARTS BEING FORMED from laminated phenolic sheeting by the McQuay Aircraft Corp. is this chin turret fairing for the B-17 Flying Fortress (Figs. 5, 6) which measures approximately 50 in. in length by 40 in. in width. The part fits just behind the chin turret and is used to fair the turret into the fuselage. In addition to this fairing the company is producing by the same methods an ammunition chute with an over-all length of more than 90 in., an ejection chute scoop, ammunition deflector, dome-light bracket, deflector ring, spinner fairing, fireman's hand-axe bracket, and more than 25 types of ammunition boxes.

One of the principal advantages of producing these parts from plastics is the saving made possible in tooling costs, based upon the fact that phenolic materials require approximately one-third the number of tools necessary for the forming of metal. Other advantages of plastic parts are as follows: as much as 50 percent can be saved in the original cost due to the fact that plastics require only about one-half the production man-hours of metal. The laminated phenolic parts are from 25 to 50 percent lighter in weight than metal and show greater durability.

Credit—Forming by McQuay Aircraft Corp.

* Registered U. S. Patent Office.



PHOTO, COURTESY VIRGINIA-LINCOLN CORP.

The hub of the home

by J. D. LINCOLN*

NOT only is the military use of glass-reinforced low-pressure plastics well beyond the laboratory phase, but postwar applications of these remarkable new materials are now more than mere dreams. Among them, models for a space-saving, structure-supporting prefabricated kitchen and bathroom unit which might be called the hub of the home, are important architecturally but the peculiar suitability of glass laminates for their manufacture deserves plastics head lines. In our company's vast new plant, these light weight superstrong materials are making important electrical equipment on a commercial scale, and the techniques already worked out can go directly—and profitably—into civilian production as soon as restrictions are lifted.

Properties, history and laboratory-developed techniques for handling plastic-reinforced glass and its satisfactory performance as experimental primary structures for military aircraft, have been fully covered in these pages by a series of articles.[1] However, the recently developed "Heart-of-the-Home" unit and plans for its manufacture throw new light on the potentialities of low-pressure glass-reinforced moldings for prefabricated housing.

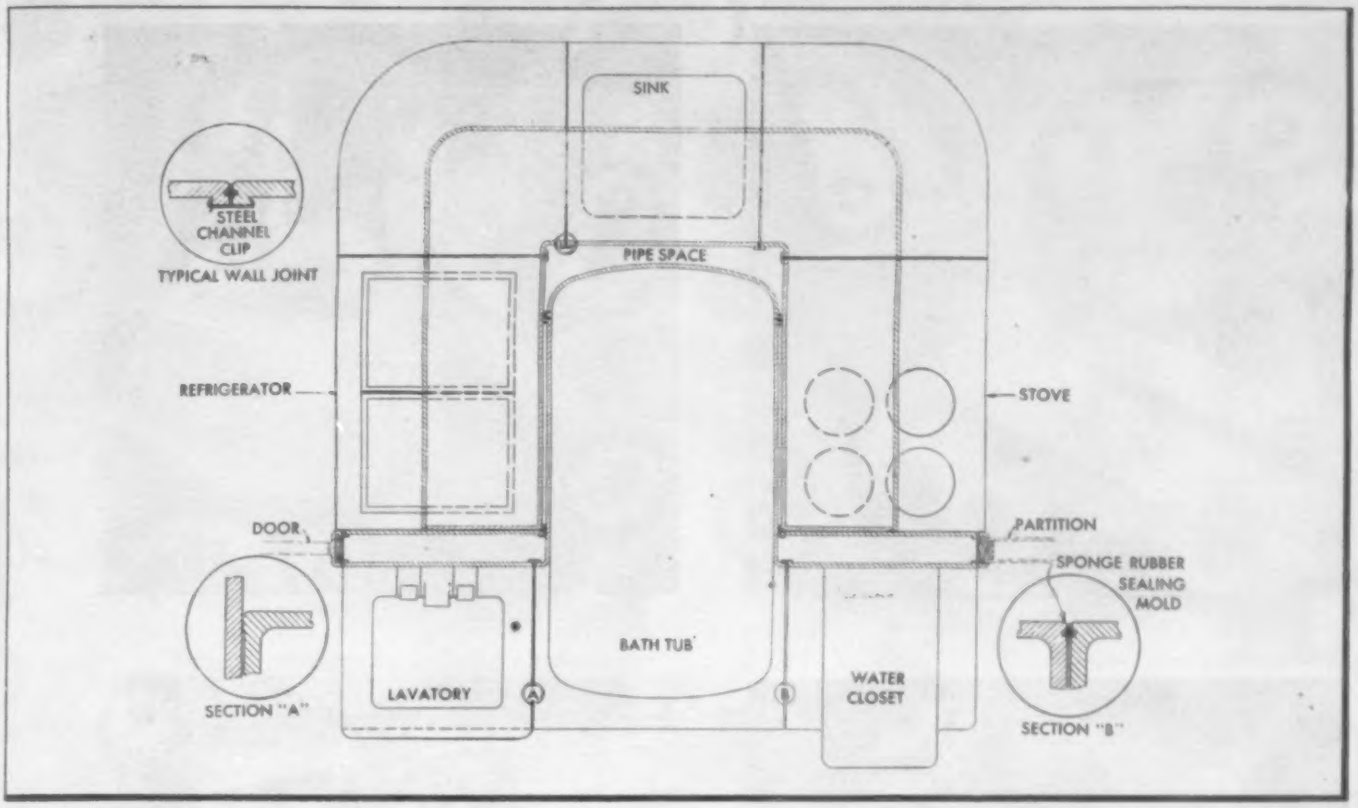
Implicit in their advantages for this type of structure are their possible applications for refrigerators and plumbing units and for strong, light, highly stain- and mar-resistant furniture for existing bathrooms and kitchens. Because of these features, as well as because of their dimensional stability, glass laminates could make ideal weatherproof outdoor furniture. Chairs and tables for terraces, and even park benches would be impervious to rain and sun, would require no upkeep. Made by low-pressure methods, they could be molded inexpensively in whatever complicated form-fitting curves the designer fancies.

The prefabricated utility unit

Principal innovation of the projected bathroom-kitchen design is that it takes advantage of the ideal properties of glass laminates for individual units which are integral with standardized interchangeable wall sections. Their strength-weight ratio is high, their resistance to scratch and to acids and alkali in foods and soaps, their dimensional stability and insulating properties are excellent, and large unit moldings are possible at low tooling cost. Designed especially for construction in these materials by the industrial designing firm of Sundberg & Ferar, who have long been pioneers in plastics applications and who have worked extensively in the refrigeration, furniture and household appliances fields, many of the excellent features of the design would be impracticable to manufacture if the costly dies of high-pressure molded plastics were necessary, and assembly on the spot would be too complicated were they to be made of lightweight metals.

The two-sided unit, which comprises a bathroom and a kitchen complete with full storage facilities, in its most compact form would occupy a space only 7 ft. square and can, because of its airplane-type cantilever beams, carry the entire structure of the house as shown in Fig. 1. Similar to analogous assemblies in aircraft and automobiles are the factory-assembled plumbing, wiring and heating ducts which are built in. For support, a small concrete foundation, incorporating the plumbing, sewage, gas and electric outlets, is

* Chief engineer, Virginia-Lincoln Corp.
[1] See MODERN PLASTICS *21*, 89–112 (May 1944).

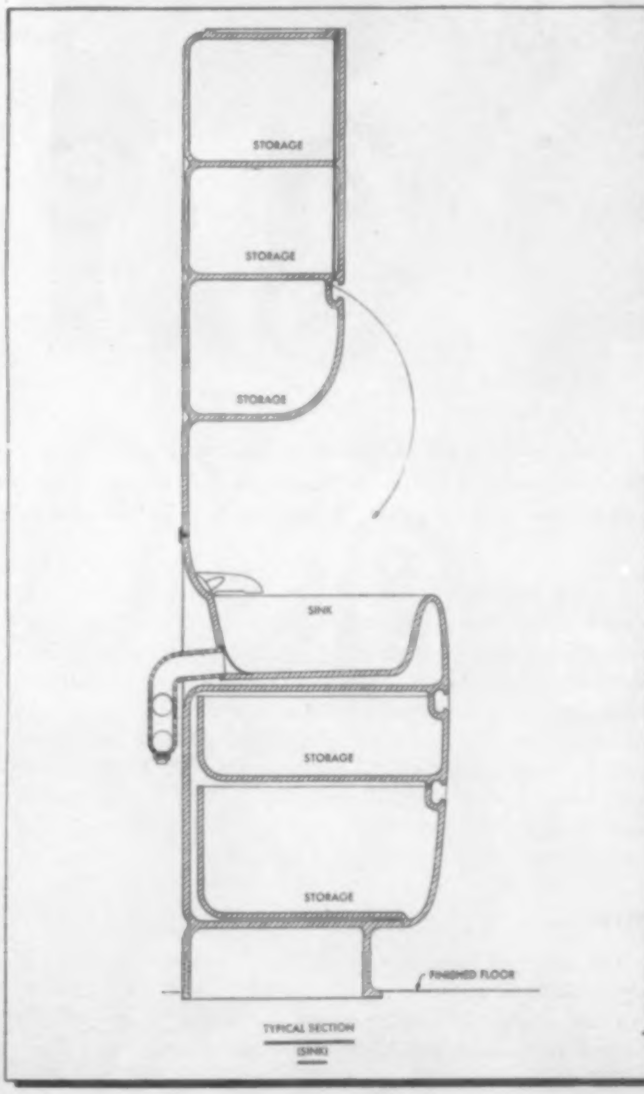


DRAWINGS DESIGNED BY SUNDBERG AND FERAR

2

2—In this exploded view of a kitchen-bathroom unit, the kitchen forms the outside of a "U" of which the bathroom is the inside. 3—This section diagram demonstrates the careful planning of adequate storage space

3



all that is required when the assembly is to serve as the focal point of a new house.

Functional and handsome, both bathroom and kitchen are adaptable to a great variety of straight-in-line, square, and L-shaped layouts. One room can be had without the other, and individual sections of each room will be available. The "exploded" view in Fig. 2 illustrates the sections and the manner in which they are fitted together. The designers' favored arrangement, and the most forward-looking one, is the successful *tour de force* accomplished by the 7 by 7 ft. plan (Fig. 2). Here the entire kitchen forms the outside of a "U" of which the bathroom is the inside. Stove, refrigerator and sink are strategically placed in relationship to each other and are separated by cupboards triangular in plan which form the curves. In the bathroom, the bathtub and shower nestle into the "U" of the kitchen, and are flanked on either side by the lavatory and toilet.

Bathtub walls extend to the ceiling, forming a shower room in which tiles become unnecessary. There is a recess for the shower curtain, and other accessories are built in. By the compact arrangement, and because the curves of the molded fixtures will eliminate sharp corners, hazardous, hard-to-clean nooks will be done away with.

Streamlining and space saving will be features of the kitchen no matter what floor plan is used. The amount of work and storage space within a small area are a housewife's dream, for at table height, a continuous working surface is provided as she moves from unit to unit, while above and below every cubic inch not needed for sink, stove and refrigerator is used for cabinets to hold dishes, foodstuffs and cleansers. The section diagram, Fig. 3, demonstrates what careful planning

4

5

ALL PHOTOS, COURTESY VIRGINIA-LINCOLN CORP.

6

7

4—Glass cloth is passed between impregnating rolls at a speed of 100 ft. per minute. 5 and 6—After impregnation, the material is returned to room temperature where the resin resumes its viscosity. The cloth can then be laid up on the form without the use of staples. 7—An expendable gas tank being wrapped around a male form in making a power plant duct

has gone into this aspect of the design. Dirt-collecting corners are as obsolete here as in the bathroom.

The lower shelves of the cabinets will be constructed with racks which let down and permit dishes to be stored horizontally—no more digging for the dishes at the bottom of the stack, and less breakage! Added refinements will be the built-in electric toasters and food mixers. The oven, placed high over the stove rather than below, will eliminate tiresome bending to baste the roast or test the cake, and the refrigerator will be functional in design.

Materials

The non-structural portions of these units can be made of low-pressure laminated glass-fiber cloth, canvas or duck. For the highly stressed primary members, however, the newest glass flock and fiber technique[2] may be employed. In this material, straight-line continuous glass fibers are coated with a resin admixed with short lengths of finely divided glass-fiber flock. The flock fibers, with diameters approximately one-sixth that of the main fibers, are interspersed among the main strands, reinforcing them. The resultant material, which may be compared with a monolithic column, has much more compressive strength than one with a fabric filler where strength is divided between warp and woof.

Glass fibers might also be used as insulation for refrigerator and stove. Resin-sprayed fiber wool is now standard insulating material in all types of military and merchant ships. For kitchens, it would lend itself well to use with low-pressure molded glass-filled plastics as the center of a sandwich type of construction.

Molding methods

New materials usually require new techniques, and the low-pressure glass laminates are no exceptions. Many refine-

[2] Developed by Owens-Corning Fiberglas Corp.

ments are still to be worked out; many have been tried in the laboratory. However, the handling techniques are already far enough advanced for war production on a commercial scale and for postwar adaptation.

Our company has, through the use of heavy viscosity resins which polymerize at 125–150° F., overcome some of the difficulties presented by these materials.[3] These have been found to be infinitely easier to work with than the earlier types of low-viscosity high-temperature resins. When they are employed, glass cloths which are to be impregnated are passed through the liquid resin on rollers (Fig. 4) or the resin can be applied by means of a doctor knife. After the glass fibers have been thoroughly saturated and coated, the material is returned to room temperature where the resin again assumes its viscosity. The sticky material can then be laid up on the form easily and without the use of staples or soldering irons (Figs. 5 and 6), for in this state it will cling to the entire area of the form. Since it is soft and pliable, it will adhere even to the most complex curves, thus obtaining shapes which cannot be profitably produced with any other type of plastic.

[3] See "Desirable Handling Properties of Low-Pressure Resins," MODERN PLASTICS *21*, 110 (May 1944).

After the resin has been added, and the material laid up on a male mandrel or form it is then transferred to a female mold (Fig. 7). It is now ready for curing. The simplest method at present is to cover the assembly with a rubber blanket pressure-sealed on the edges, draw a vacuum, and put it in the oven for the length of time and at the temperature required by the particular resin employed.

Molds can, of course, be made of any material which will withstand the temperature necessary for the cure; and wood, plaster of Paris and cast phenolics are some which have been employed. The mold must be protected by cellophane or a similar film which will be unaffected by the resin. For high production, a metal mold might be warranted and the oven baking could be eliminated by steam heating the mold. For experimental or limited production, however, the fact that inexpensive molds can be employed is an obvious advantage.

An answer to the manufacturers' prayers will come when resins of proper consistency which will cure not only without pressure, but also without heat are commercially applicable. Already in the laboratories, they will, when fully developed, still further reduce the cost of molded plastics and broaden the already wide horizons of their applications. For certain types of structures, they will entirely dispense with the heating operations. Molds can then be made of even cheaper materials, and the operations will be simplified.

Properties

Advantages of low-pressure molding materials for the projected kitchen-bathroom are—from an engineering point of view—legion. To the sim- (*Please turn to page 194*)

8

9

8—Spot welding is employed to tack the impregnated cloth. 9—Glass fiber skin being tailored in the mold preparatory to the forming of an aircraft structure

PLASTICS IN REVIEW

1

1 Shipped to the Southwest Pacific for test as soon as they were developed, 100 coated nylon ponchos have withstood more than 6 months of hard use. These ponchos, which weigh about 30 oz., are coated with vinyl-type synthetic resin, and serve as raincoats, foxhole covers, ground sheets, moisture-impervious bed rolls or as one-half of a shelter tent

2 To offset the increased stress on insulating materials brought about by the installation of watthour meters in exposed locations and by inverted sequence of connections and interconnections of lightning arrestors and secondary grounds behind surge-proof transformers, Sangamo Electric Co. now uses mineral-filled Melmac for terminal insulation in its watthour meters

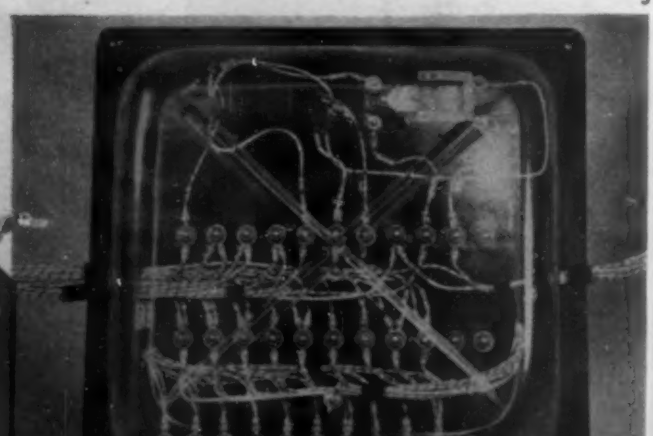
3 Ease of assembly and maintenance are two of the advantages of the plastic electric junction box developed by the Glenn L. Martin Co. for use on its new plane models. Reversing present practice, a flat plate is used as the main section, and installations and wiring are attached to this base surface. A transparent cover molded of Plexiglas completes the unit

4 To any housewife who has fumbled through her change purse in search of elusive tokens, these Toters are time and temper savers. The containers are molded by Commerical Plastics Co. for All Plastics, Inc., in two parts of either transparent or opaque Tenite. Before the two barrels are acetoned together, a metallic spring is placed inside

5 To meet the need of the Army Air Forces for a message carrier which may be dropped from a height of 5000 ft., Dayton Manufacturing Co. assembles this 12-oz. container from 3 parts: an inner core holding two pencil-type batteries; an orange streamer which serves as an aid to identification and a parachute;

2

3



4

5

and an outer fiber tube protected at either end by transparent Lumarith caps into which light bulbs are fitted. The caps are molded by Richardson Co.

6

6 There can be no excuse for poor grooming when beauty preparations are packaged in containers as compact and easy to operate as those used by Clairol, Inc., for its brushless mascara stick and brush touch-up crayon for grey hair. The containers are molded of Bakelite polystyrene in three parts by Bridgeport Molded Products Co.

7 Over 200 power companies are using this trade character, Reddy Kilowatt, in advertising and public relations programs. Injection molded of Fibestos by Mack Molding Co. for Ashton B. Collins, they have found wide acceptance as counter displays

8 Continued and steady usage of flashlights in industry is responsible for the development of a rechargeable wet storage battery to replace the critically short supply of dry cell batteries. These batteries, molded of polystyrene by Elmer E. Mills Corp. for B. F. Goodrich Co., have proved more economical than dry cells in volume use

7

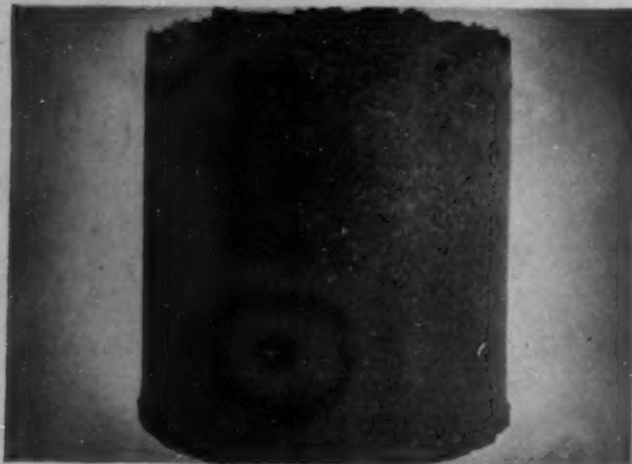
8

Putting on the brakes

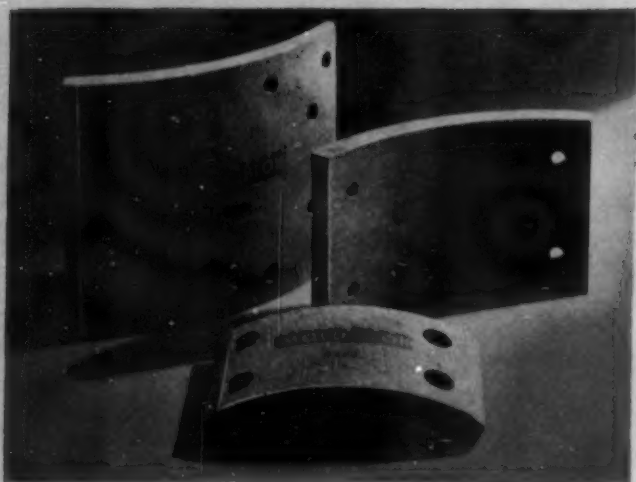
by C. R. SIMMONS*

PHOTOS, COURTESY MOLDED MATERIALS DIV., PHARIS TIRE AND RUBBER CO.

1



2



3

"KEEP 'em rolling." Today, this is the chief concern of those engaged in the field of bus, truck, trailer and aircraft transportation. While getting equipment under way is truly the first problem, the second is control once it is moving. For the past several years a division of the Pharis Tire and Rubber Co. has been doing a real "stopping" job for our overburdened transportation system through the production of molded brake blocks, or linings, for commercial vehicles.

Braking materials have, of course, been made for many years, and the basic ingredients for all the many types are fundamentally the same—asbestos, rubber, metal, lubricants, carbons, plasticizers and resins. For the purpose of clarity, discussion in this article will be confined to a description of one type of a commercial brake block made by this tire and rubber company for use on heavy-duty trucks.

Among the basic materials going into this individual brake block are phenolic resin, asbestos, lead and graphite with the final physical characteristics of the block determined by the percentage of each material that is used. While the phenolic resin was originally intended as merely a bonding agent, it has been found to be of aid in firmly establishing the homogeneity of the block, improving frictional characteristics, increasing the life and wearing qualities of the product. After the raw materials have been combined, they are given another mixing at which time a plasticizer—one of the alcohols—and another lubricant of an oil type are added. This addition, designed to facilitate further handling of the mixture, not only simplifies preforming but reduces die friction in a subsequent operation.

After the second mixing, the material no longer has a coarse fluffiness but tends to become more compact while retaining its fibrous appearance. Since the material is to be extruded and therefore requires some form that will simplify handling, it is pressed into a form called a "charge" which resembles a huge molding compound preform (Fig. 1). Each charge weighs about 15 lb. and has a diameter which is only slightly smaller than the diameter of (*Please turn to page 196*)

* Durez Plastics & Chemicals, Inc.

1—In the molding of brake blocks, the material to be extruded is pressed into a "charge," or huge molding compound preform. 2—Brake blocks of various sizes ready for shipment. 3—For use in heavy duty vehicles, the blocks are assembled on brake shoes. 4—A continuous strip of brake block as it comes from the extruding machine

4

PLASTICS*

Engineering Section

F. B. STANLEY, Editor

Powering a rotating turret

THE present trend in military airplane design would seem to be toward increased defensive fire power. An example of this change in tactics is a Navy plane that carries, in addition to a machine-gun complement for firing directly ahead, two maneuverable machine-gun turrets. These turrets are mounted one above the other with each unit operating independently.

Because of the location of these two turrets with relation to each other and because of the large amount of equipment necessary for their operation, a great deal of engineering ingenuity was necessary to design a workable assembly that left space for the installation of all necessary equipment. As a matter of fact, after the hydraulic and oxygen systems had been designed, only $4^{1}/_{4}$ in. were left in which to install the electrical equipment. In other words, while the hydraulic and oxygen systems were engineered in the plane, the electrical equipment had to be built to fit into whatever space remained.

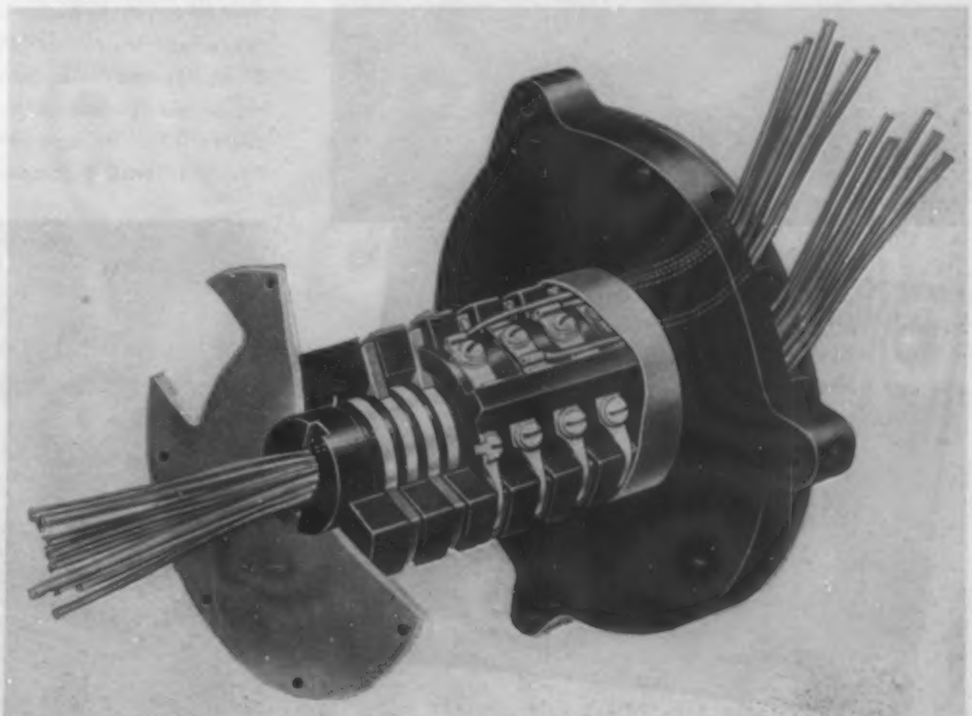
To effect a connection between the various circuits in the body of the plane and the moving turrets, a slip ring and brush assembly system (stator and rotor) was selected in preference to a flexible cable which would permit only a limited number of turret revolutions. A cut-away view of this turret swivel joint (Fig. 1) clearly indicates the complexities of the assembly. The rotor was designed so as to be stationary on the gun turret, while the stator or brush holder was engineered for permanent mounting in the main body of the plane.

The rotor assembly

The rotor is made up of twelve slip rings each of which is $^{1}/_{8}$ in. wide with an O.D. of 1 in. and an I.D. of $^{3}/_{4}$ in., and composed of 97 percent silver and 53 percent platinum. Connected to each of these rings is a lead wire approximately 18 in. long—making a total of twelve lead wires. Number 18 wire is used for the ten leads that serve as telephone, radio, etc., connections; number 12 wire is employed for the two power leads. The balance of this rotor assembly consists of transfer-molded diced Rogers board which carries a classification of CFI-5 under Navy specifications 17-P-4.

Figure 2 shows the first operation in the loading of the hand mold for the production of one of these rotors—the assembly of twelve slip rings in slots provided for them in the lower half of the cavity. The connecting lead wires, which have previously been soldered to their respective rings, are held together by a fabric sleeve. A round insert is assembled in the cavity at the opposite end from that taken up by the lead wires. In Fig. 2, the operator is about to place

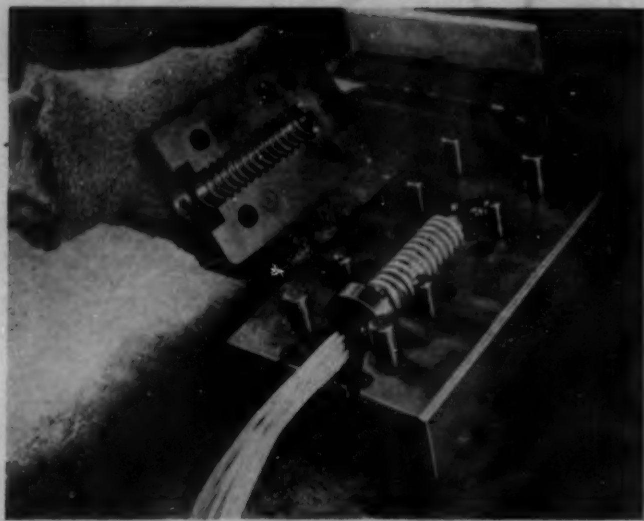
PHOTO, COURTESY PLASTIC MANUFACTURERS, INC.



1—*Phantom cut-away view of a turret swivel joint which clearly indicates the complexities of the assembly. Much engineering ingenuity was necessary in order to design a workable assembly that would leave adequate space for the easy installation of all the needed equipment*

*Registered U.S. Pat. Office

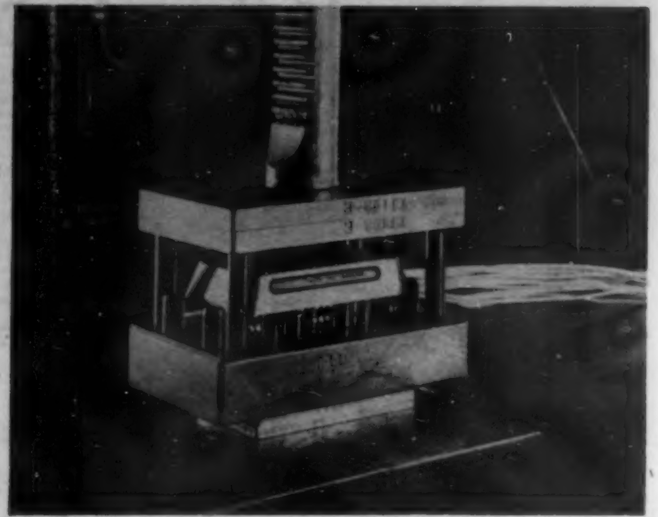
2



3

4

5



ALL PHOTOS, COURTESY PLASTIC MANUFACTURERS, INC.

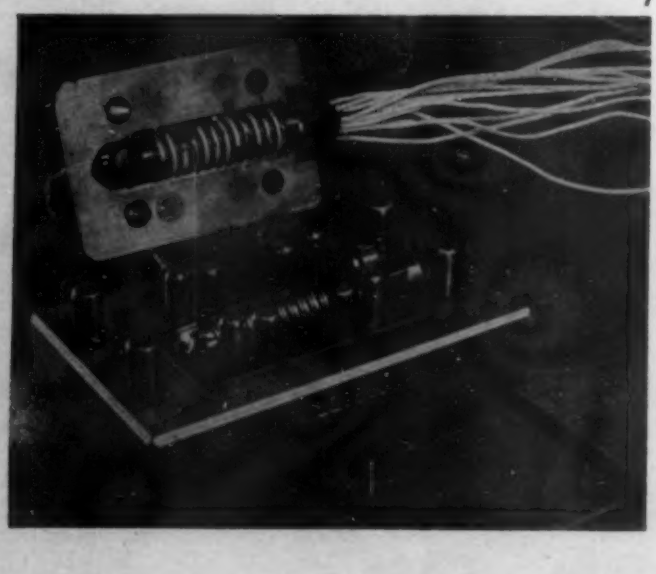
6

in position the top half of the cavity which also has grooves for nesting the slip rings. After the top half of the cavity has been fitted into position, a combination chase and adapter plate is placed on top of the assembly (Fig. 3). This plate is designed so that its bottom half fits perfectly over the top half of the cavity while its top half mates with the lower portion of the hand transfer pot. The sprue hole can be seen in the right-hand side of the cut-out portion of this plate (Fig. 3). Finally, the hand transfer pot is assembled in position on top of the chase so that its sprue hole mates with the hole in the chase.

Figure 4 shows the mold, chase plate and transfer pot assembled into a complete unit and the material loaded. The operator is about to place the transfer plunger in position inside the transfer pot preparatory to positioning the entire

2—Lower half of cavity loaded with slip ring inserts. Each ring is connected electrically with one of 12 wires. 3—Top half of cavity in position. Chase plate is about to be assembled to mold. 4—Mold, chase plate and transfer pot assembled into a complete unit. 5—Lower half of cavity is being forced down by means of an arbor press which presses down on top of the adapter plate. 6—Upper and lower halves of cavity after they have been separated by means of the lower knockout and upper adapter plates. 7—The operator holds the upper half of the cavity in which completed molded part is still retained

7



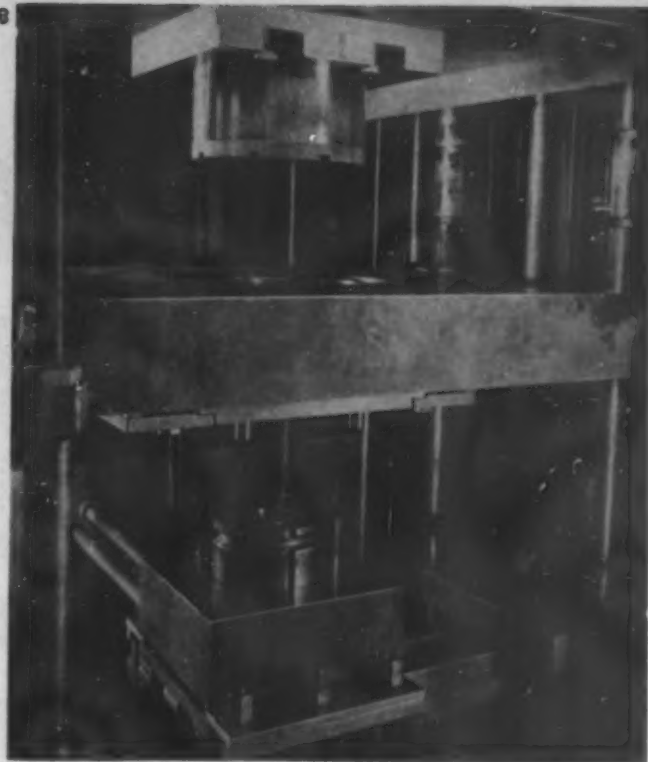
unit in the hydraulic press. After a cure of approximately 4 minutes' duration, the transfer pot and chase plate are removed from the mold.

It is then necessary to separate the upper and lower halves of the cavities. Engineers at the molding plant have devised a system which makes use of one knock-out plate and one adapter plate with four legs. In Fig. 5 the lower half of the cavity is being forced downward by the pressure exerted by an arbor press on the top of the adapter plate. Four pins in the knock-out fixture at the bottom of the assembly are holding the upper half of the cavity in a fixed position while the lower half of the cavity is being forced down and away from the upper half. Upon completion of this operation as shown in Fig. 6, the two halves of the cavity are separated with the molded part held in the upper half of the cavity. After raising the plunger of the arbor press, the operator removes the adapter plate and lifts up the top half of the cavity with the molded piece still in place (Fig. 7). Finally, a small two-pin knock-out fixture is used to remove the molded part from the upper part of the die.

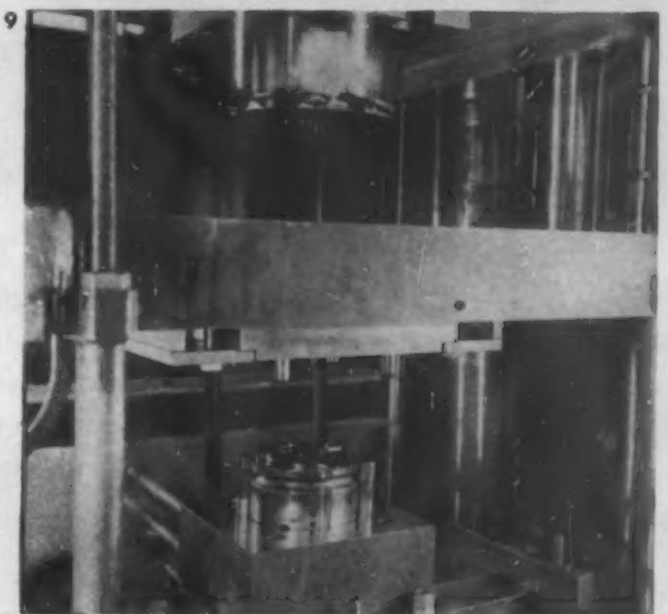
Because an opening must be maintained at all times at one end of the mold to permit the lead wires to pass to their respective slip rings, close control of the weight of the material and the pressure exerted during transfer is necessary. If an excessive amount of material is placed in the transfer pot, it would exude around and between the 12 lead wires. According to the molder this objectionable feature is overcome by holding the variation in the transfer charge to within $^1/_2$ gram.

Another difficulty encountered in the molding of the rotor involved the insulation of the lead wires. Due to the high heat of the mold—approximately 325°—rubber insulation was useless. Asbestos insulation was ruled out despite its ability to stand the heat because the high pressure necessary in the molding operation (*Please turn to page 186*)

8

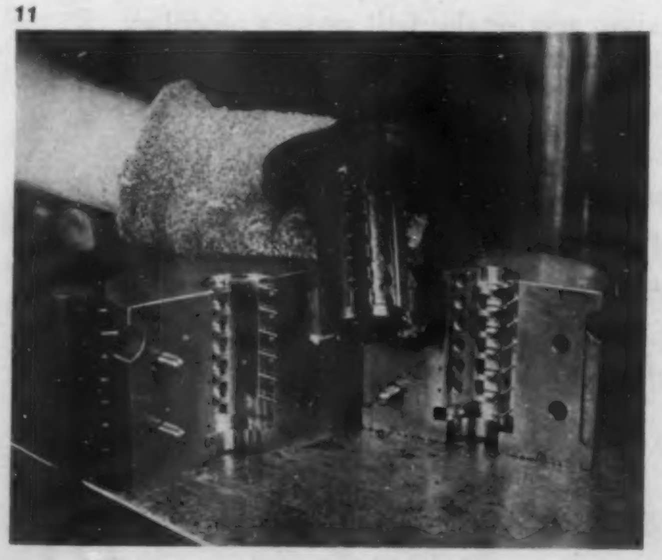


9



8—Semi-automatic transfer set-up used to mold stator. Transfer pot is mounted in bolster plate; transfer plunger is suspended from head of press; split mold is in position in chase. Knock-out pins hold mold in elevated position. 9—Complete set-up shown after mold has been opened. Mold is partially raised from chase; cull and sprues are still engaged with transfer plunger. 10—Side pulls with 6 pins for molding holes in stator being withdrawn sufficiently to disengage them from molded part. 11—Split mold has been parted. Molded part is shown as it comes from mold. Note flash on vertical parting lines

11



10

Plaskon Molded Color Closures . . .

ON AMERICA'S FINEST QUALITY PRODUCTS!

THE NATION'S STORES are bright and attractive with fine merchandise, graced by sparkling, serviceable, low-cost closures of Plaskon Molded Color. The utility value of Plaskon Molded Color makes it unusually adaptable to the closure needs of a great variety of liquids and solids in the drug, cosmetic, food, and general merchandise industries. It is highly resistant to common organic solvents, weak acids and alkalies, oils and greases. It is strong, shock-resistant, non-shattering.

Manufacturers using molded Plaskon secure the full power of color as an eye-catcher and salesmaker. People *see, buy* and *use* these products, made more attractive and inviting with closures and containers of Plaskon. In gay, brilliant hues or restrained tones, ranging from jet black to neutral white, Plaskon colors can be selected and molded to harmonize with the character of a wide range of products, and increase their sales appeal. We can give you helpful assistance in suggesting designs, qualified Plaskon molders, and technical advice so that you can efficiently adapt Plaskon Molded Color to your use.

PLASKON DIVISION • *LIBBEY·OWENS·FORD GLASS COMPANY*

2121 SYLVAN AVENUE, TOLEDO 6, OHIO • *Canadian Agent: Canadian Industries, Ltd., Montreal, P. Q.*

PLASKON

TRADE MARK REGISTERED

MOLDED COLOR

These models of lamp guards incorporate plastics in their construction: The first has a molded phenolic cage; the second, a fiber cage, phenolic handle and knob; the third, a molded handle

Lamp Guards and Switch Assemblies

THAT the McGill Manufacturing Co., Inc., has for many years been plastic conscious is evidenced by the sturdy plastic handles and assemblies employed for its line of lamp guards and vapor-proof lamps. Recently, the company has added further important plastic applications. Plastics now serve in the place of critical brass in a redesigned line of high-grade lighting fixtures and levolier switches, and the redesigning has been exceptionally successful.

Lamp guards

Out of the established line of lamp guards, one model has a molded phenolic cage while others are equipped with molded handles and seals so arranged as to complete a vapor-proof unit. Thus far, Line 999 is the only guard assembly to employ a molded cage, a part which is available with or without a halfshade. Produced in a single-cavity mold, this cage is made of rag-filled material which is macerated to give the desired strength. The handle of this assembly is of rubber with a steel core reinforcement.

A fiber cage or guard is a new departure in the design of vapor-proof portable lamp No. 3007, a model that is also available with a metal cage that can be interchanged with the fiber part. A glass globe, macerated phenolic handle and molded end knob complete this assembly. Both handle and end knob are produced in single-cavity molds.

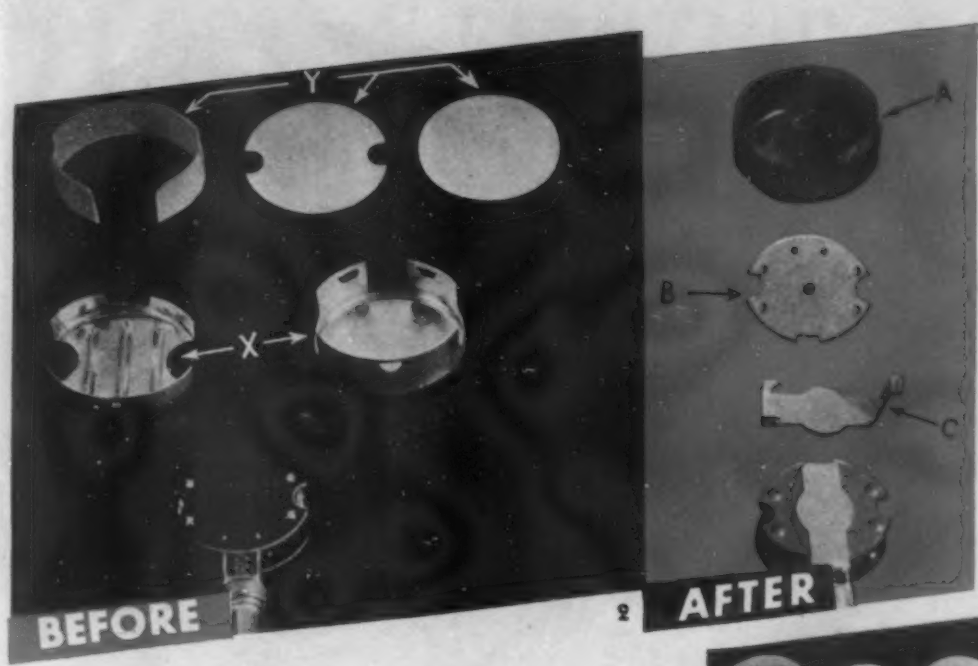
For several years vapor-proof lamp No. 3002 and its larger version, No. 3005, have enjoyed considerable popularity. These lights comprise glass globes, metal cages and rag-filled macerated molded handles which are non-rolling and are designed for ruggedness. Like the handle on the No. 3007 line, these are made in one-cavity molds; end knobs on all three vapor-proof lamps are identical.

Switches

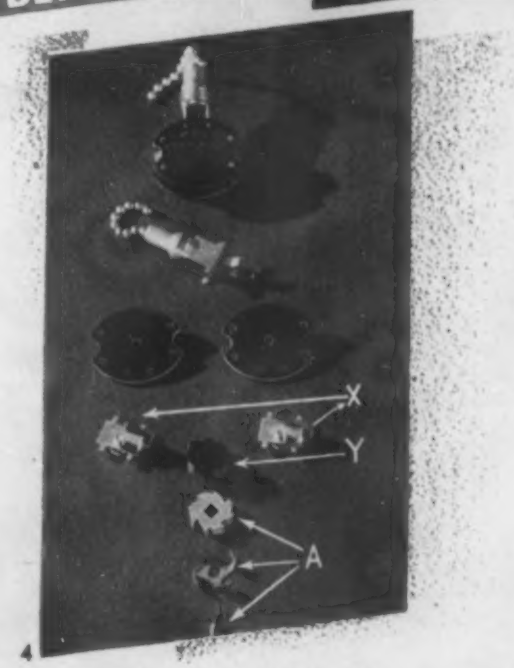
In the manufacture of switches, the necessity for the replacement of brass by some other material became pressing even before the United States actually entered the war, for this metal, so widely used in the electrical-fixture industry, was already urgently needed for the war effort and was only available for those switches which did the most important war jobs. Since, at the time, plastics were already well-known replacement materials, a company enginer redesigned the line for their use. During the first year, the use of plastic saved this company many thousand pounds of brass—the final cost of manufacturing the switches being about the same in plastic as in brass.

One of the most important of the brass switches, a fixture switch known as No. 41, had a rating of 6 amp. at 125 volts and 3 amp. at 250 volts. The compactness of this switch and its comparatively high rating, made it one of the company's more popular units. Figure 4 shows the component parts of this switch. Three parts indicated by x and y are contacting parts for making and breaking circuit. Two beryllium copper spring contactors (indicated by X) are mounted diametrically opposite each other and rest either on the insulating teeth or on the conducting teeth of the rotating rachet (shown by Y). This rachet is in turn assembled from the three parts marked A in Fig. 4. Obviously, if the contactors rest on conducting teeth, the circuit is on. If they rest on insulating teeth, the circuit is off.

This small fiber rachet and metallic rachet insert was the first successful conversion to plastics. Several of these assembled rachet units were machined by hand from molded phenolic material. Doubt was expressed as to whether or not the phenolic gear teeth would stand up under heavy usage, but the 10 or 12 handmade samples proved that no difficulty would be experienced on this score. However another difficulty did arise—the definite "tracking" of the phenolic material. As the contacting springs broke the circuit, they dragged an arc across the face of the insulating teeth which charred the surface and eventually made this supposedly insulating surface a good conductor of electricity. This "track-



2—(Left) Portions of a brass housing for a switch and (right) their molded replacements; 3—Redesign of this fan switch housing resulted in the development of a new switch. 4—The component parts of a brass fixture switch which was successfully converted to phenolics



ing" of plastics has been a problem which materials engineers have been attempting to eliminate for a good many years. To eliminate the trouble, this company substituted high-grade horn fiber for phenolic in the contact disk proper while continuing to mold the small gear portion of this assembly.

The two portions of the brass housing indicated by the letter *X* in Fig. 2 were naturals for plastic substitution. However, instead of merely substituting a phenolic material for the brass without changing the style of the switch, this company completely redesigned the entire unit. The component parts of the redesigned switch are shown at the right in Fig. 2. In place of the top and bottom brass shell housings (*X*) which, incidentally, had to be insulated with three die-cut fiber parts (*Y*), the molded housing (*A*), the small spring clip (*C*) and fiber cover plate (*B*) were substituted. Thus we have three die-cut fiber parts plus two formed brass shell portions being replaced by one molded housing plus a spring clip and fiber cover plate. The phenolic casing was first produced in an 8-cavity mold which cost approximately $1500. Since then several more molds have been built to take care of increased production. The company states the replacement of metal by any other material would have involved a far greater cost in tooling-up than that attendant upon the purchase of the plastic mold. Under any circumstances, the results would not have been as satisfactory. This company also states that its customers are of the opinion that the phenolic housing is a great improvement over the brass casing.

Another conversion job, which actually resulted in the development of a new switch, involved the redesign of the fan switch housing known as the No. 1050 case (Fig. 3). In many instances, levolier switches that were mounted for fan housings were not insulated. This was due to the belief of the fan manufacturer that the fan housing would give sufficient protection and that it was not necessary to do this insulation job twice. However, while the switch was protected from dust and dirt, it was definitely not protected from possible shorting either against the fan housing itself or against loose connecting wires inside of the unit. For this reason, McGill offered their fan switches in two ways—protected and non-protected. When they were forced to cease production on brass housings, they promptly redesigned the switch completely and came up with a unique design. While the (*Please turn to page 192*)


Life
ON THE
PLASTICS
NEWSFRONT
Two mineral-filled MELMAC* distributor heads and fingers in each of the four Wright 2200-horsepower radial 18-cylinder Cyclone engines.
High arc-resistant MELMAC for circuit breakers and relays.
BEETLE* covers on precision snap action switches.
Self sealing gas tanks with LAMINAC* backing.

PLASTIC FIGHTING POWER in the B-29 SUPERFORTRESS

INERAL-FILLED MELMAC

The high arc-tracking resistance of mineral-filled MELMAC*, plus its dielectric strength and heat resistance, are of the utmost importance in the mechanical operation of the B-29 Superfortress. These outstanding properties account for its widespread use:

Dielectric Strength—430 Volts/Mil.
Arc Resistance—(ASTM)
Avge. 130 Secs.
Heat Resistance—300° F.

ALPHA-CELLULOSE-FILLED MELMAC

Resistance to moisture absorption, extreme surface hardness, lack of odor and taste, white sanitary appearance, make alpha-cellulose-filled MELMAC suited for food containers, tableware, and coffee makers.

BEETLE

Precision molded plastic housings utilize BEETLE* because of its color for ready identification, and possibilities for high speed production, as well as its dielectric strength, dimensional stability and light weight.

LAMINAC

Large, complex shapes, laminated with LAMINAC* are exceptionally light in weight, extremely strong, and extraordinarily tough. They have a hard smooth surface, good dielectric strength and dimensional stability.

CHOPPED-COTTON-FABRIC-FILLED MELMAC

The dielectric strength, high arc resistance, flame and shock resistance of chopped-cotton-fabric-filled MELMAC also suit it to special requirements. Added to these properties are surface hardness and resistance to moisture.

In planning your use of plastics for electrical or mechanical applications you may find our experience helpful in a discussion of your problems. Your inquiry will receive prompt attention. Further information on any Cyanamid Plastic will be supplied on request.

*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
30 Rockefeller Plaza, New York 20, N. Y.

Types of transfer mold*

by J. H. DUBOIS†

ALL PHOTOS AND DRAWINGS, COURTESY SHAW INSULATOR CO. 1

1—Transfer molding is necessary for the successful molding of these melamine-formaldehyde parts. 2—Drawing of a loose plate or hand transfer mold. The loose plate provides the top molding surface and the bottom of the transfer chamber. It is gated around the outside perimeter

THE term "transfer molding" was chosen to identify the method and apparatus for molding thermosetting materials whereby the material is subjected to heat and pressure, forced into a closed mold cavity by this same pressure, and held there under heat and pressure until curing is complete. Louis E. Shaw, who invented the process, stated that the object of his invention was to introduce the plastics material into the mold in a highly plastic state to secure free flow.

The transfer type mold is selected for many difficult molding jobs, since it can be used for many applications that cannot be molded easily with the conventional compression molds. Among the many desirable features that are obtained by the use of transfer molds are the following:

1—Intricate sections and difficult side cores may be molded.

2—Delicate and complicated inserts can be used.

3—Small and deep holes may be molded.

4—Molded parts may have greater strength.

5—Parts molded in this manner have greater uniformity in their density.

6—Closer tolerances may be held. This is especially true of those dimensions that are dependent on the opening and closing of the mold.

7—Parting lines require less cleaning or buffing since there is almost no fin. This is extremely important when the rag-filled materials are used.

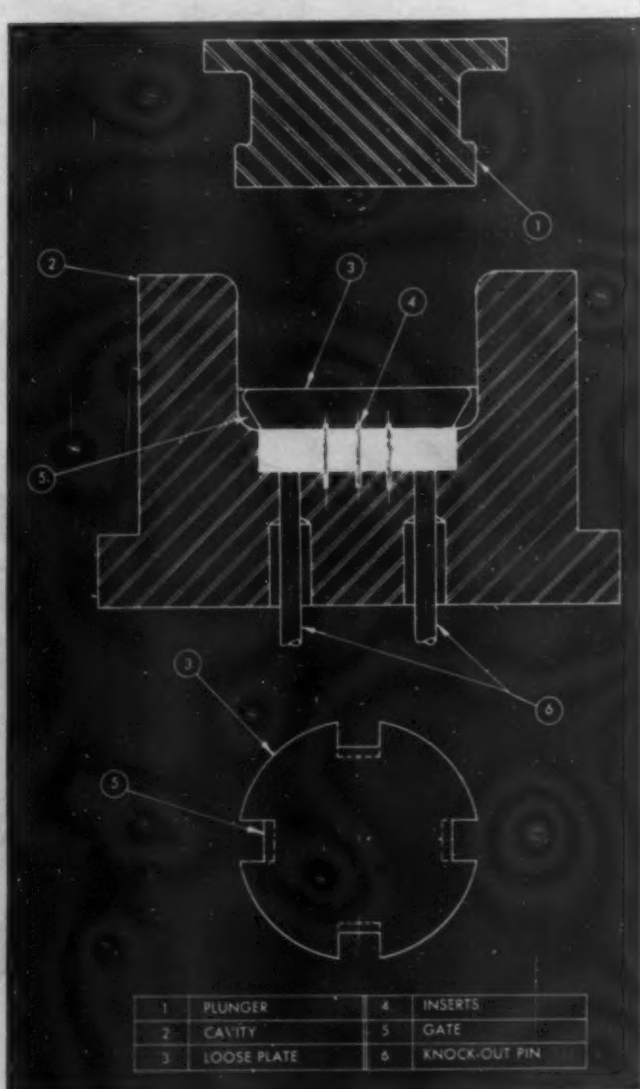
8—The heavy cloth-filled materials and several of the melamine-formaldehyde compounds may be molded more successfully with transfer molds.

9—When used with an auxiliary press ram and suitable preheating methods, transfer molding is often the fastest and lowest cost molding method for a wide variety of jobs.

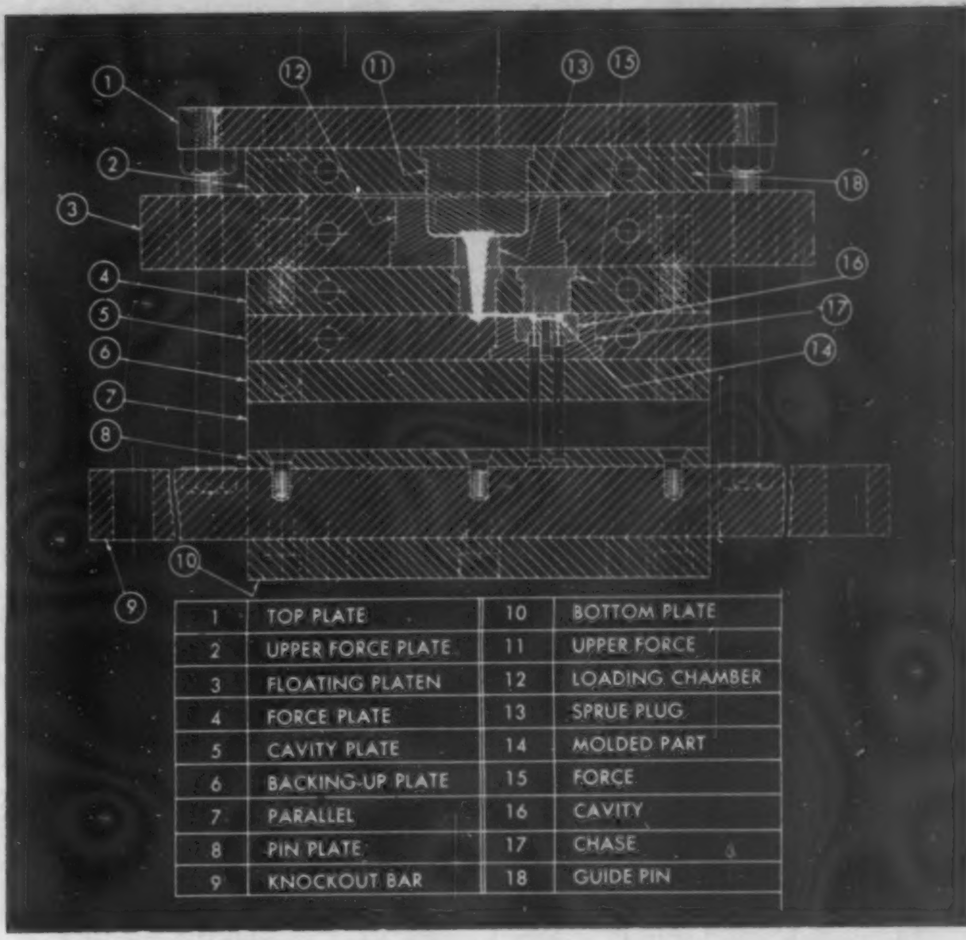
In many cases, the cost of a transfer mold will be above that of molds of the conventional type, and some material is lost in each cycle in the cull, sprues, runners and gates. In most cases where the above considerations are involved, however, the lower final cost of the part after all finishing will more than justify the added mold and material expense. Transfer molding provides the most successful means of molding such melamine-formaldehyde aircraft parts as are shown in Fig. 1.

Several general mold types are in common use for this work. One of the first transfer molds was of the loose-plate or hand transfer type shown in Fig. 2. This mold is especially useful when a group of fragile inserts must be included and extend through both sides of the finished piece. It will be noted that the inserts enter the bottom of the cavity and the loose plate. The gates are located around the perimeter of this loose plate and the area above the plate serves as the transfer chamber. In operation, the inserts are loaded in the loose plate and this unit is then pressed into the cavity so that the inserts enter the proper holes. The compound is

2



* U. S. Patents 1,016,495, 1,919,534, 1,993,943, 1,997,074.
† Executive engineer, Shaw Insulator Co.



3

3—Design of transfer mold for use in a transfer press. The press has a floating platen that will receive several standard sizes of transfer chamber. 4—Transfer press with floating platen. 5—Integral type of transfer mold with the transfer chamber and plunger constructed as an integral part of the mold

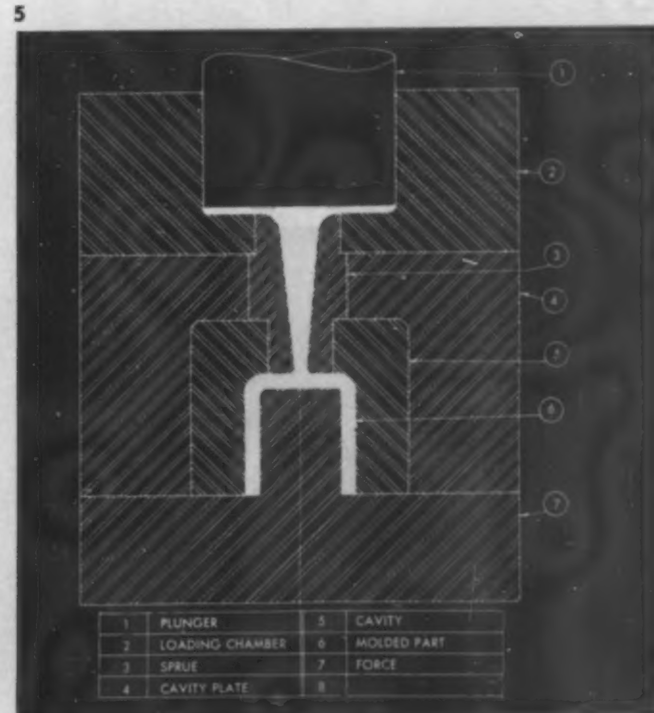
loaded above the loose plate. Transfer is effected by the transfer plunger in the usual manner. The molded piece, loose plate and cull are ejected by the knockout pins for disassembly on the bench. Two plates are commonly used to facilitate unloading and loading of the extra plate during the cure cycle.

This type of mold design is very convenient for hand transfer molds since the number of mold parts to be handled is reduced to a minimum.

Transfer presses are often employed to simplify mold design. Such presses are prepared with a floating platen having a central opening that may be fitted with a transfer chamber as shown in Figs. 3 and 4. Several sizes of transfer chamber and plunger are made (*Please turn to page 190*)

4

5



High-strength compound shapes

by V. E. CALVIN*

It has always been the hope of plastics engineers to have at their disposal a material which will produce high-strength castings in compound shapes. Since the early days of the plastics industry it has been recognized that a laminated structure is the answer to problems of strength. However, at one time such structures were only produced in objects lying in a relatively flat plane and having substantially uniform wall thickness throughout since complex laminated shapes necessitated laborious machining operations which made the production of such parts difficult and expensive. Where high strength was not a determining factor, the plastics engineer was able to turn to the custom molder who could readily provide almost any shape in easily formed molding powders and macerated-filled materials.

This former inability of the laminating industry to supply materials which could be readily formed into compound shapes of high strength frequently led the engineer to conclude that the part on which he was working, because of its combined shape and strength requirements, was not a practical plastics application. This held true despite the fact that many of these contemplated parts would have performed better had they possessed the characteristics commonly found in plastic materials.

Recognition of the existence of the problem of producing compound shapes of high strength in plastic materials led to an investigation of the possibility of solving the problem by use of kraft which had been creped on two diagonals. The two-diagonal, or X-creping, process imparts to a web the property of all-directional stretchability and produces the characteristics which permit the forming of objects of compound shape and uneven wall thickness in a continuously laminated structure.

X-creping gathers the web in from all directions, a process which results in a crowding and relaxing of the fibers and the formation of minute folds. When performed in conjunction with phenolic resins, the creping operation produces a sheet which, when laid up in laminations and subjected to heat and pressure, flows and draws in such manner that it is readily deformed into compound shapes without disturbing the structure of the filler web. The flow and draw characteristics are accomplished by removal of all or part of the all-directional stretch imparted by the creping process.

As a result of the X-creping, if the sheet is restrained at one point and a pull exerted at a point some distance away, the web gives up its stretch and elongates. Thus, the material may be drawn in much the same way that metal is drawn. Figure 1, wherein a slip-ring technique is employed to provide restraining points, clearly illustrates the behavior of the material in forming a hemispherical shape.

The flow characteristics of the X-creped material, while based upon a somewhat different principle than the draw property, is likewise a direct result of the creping process. Flow is important wherever uneven wall thicknesses, ribs, bosses, lugs, etc., must be formed. In order to illustrate the production of such details, let us consider the simple case of a flat section containing a boss (Fig. 2). A number of sheets of creped material are placed in the mold (Fig. 2a). As the mold is closed, the points of original pressure contact the materials directly under them, causing a compressive action at these points. Since the bulk of the creped web is greater than a corresponding flat web, and since this bulk can be readily reduced by the removal of stretch, the pressure at the points of original pressure forces the material at these points to give up its stretch and to move in the direction of the point of final pressure. Actually, this point receives no pressure until sufficient material has been moved into the recessed area to equalize the pressure over the entire piece.

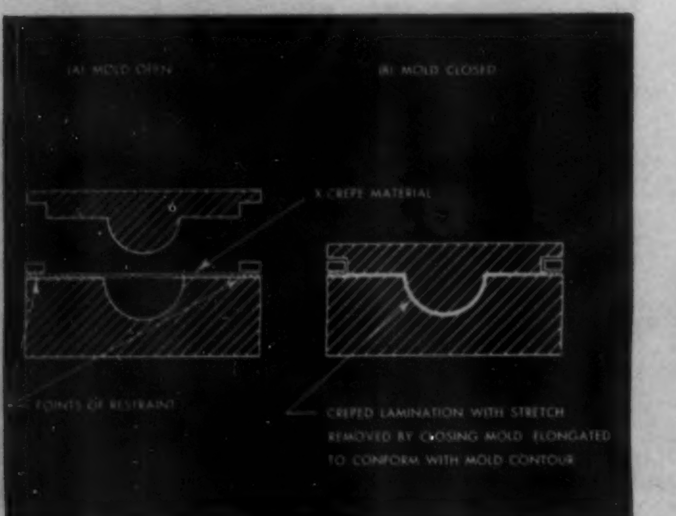
As a result of the combined characteristics of draw and flow possessed by the X-creped materials, the laminations remain

* Plastics engineer, Cincinnati Industries, Inc.

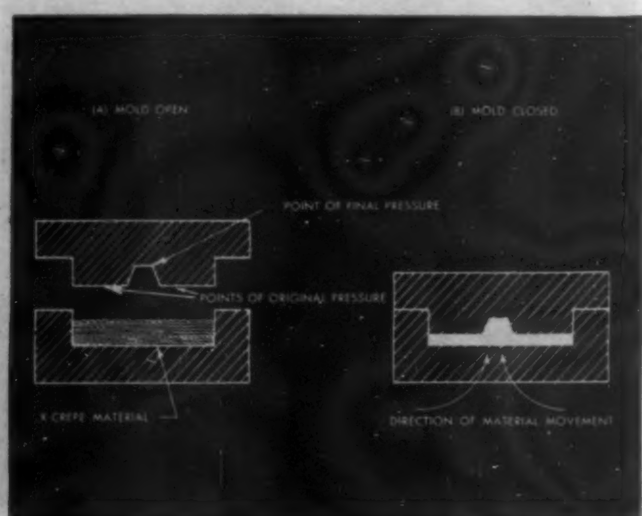
1—This drawing shows behavior of X-creped material in forming a hemispherical shape employing a slip ring technique to provide restraining parts. 2—Flow characteristics are illustrated in the shaping of a flat section with a boss

ALL DRAWINGS, COURTESY CINCINNATI INDUSTRIES, INC.

1



2



continuous throughout the castings, even though varying wall thicknesses and compound curves may be present.

Subsequent to the development of the kraft material, a demand arose for an even stronger material having the same desirable molding qualities as the all-directional stretch-creped kraft. It was found that a cotton web might be processed in much the same manner as the kraft sheet, and the same qualities of draw and flow imparted to the finished material. On a weight-for-weight basis the cloth material is considerably stronger than the kraft and is being used to form certain parts impossible to produce satisfactorily in any other plastic material. Both kraft and cloth materials may be handled in the same manner, and molding data on either material will apply equally well to the other. Both are treated with phenolic resins which are comparable in characteristics to the resins used in molding powders.

The material may be secured in varying percentages of resin to filler—the percentage selected for a given job being determined by the qualities desired in the finished casting and by the nature of the manufacturing equipment. Curing time for the standard resins is approximately 3 min. at 280 to 300° F. for 0.125-in. sections. However, where certain qualities are of paramount importance in the casting, the cure may be lengthened or the temperature varied to obtain the desired results. The new faster-curing resins have also been used satisfactorily on some applications.

Ordinarily, pieces may be taken from the mold while hot although it may be found advisable, where tolerances are extremely close, to cool the mold or pull the casting hot and cool it on a fixture. In order to prevent blistering and permit the escape of volatiles, it is sometimes necessary to breathe the mold by opening it enough so that the gases find a means of escape. This breathing should be done about 30 sec. after the mold is first closed.

Generally speaking, X-creped material may be molded in any normally constructed plastics mold of open, flash, semi-positive or positive type. While hydraulic pressure possesses definite advantages in the molding of standard-pressure resins, some items have been successfully produced in toggle-action presses. The amount of pressure that is required depends largely upon the design of the piece being molded and the design of the mold. Broadly speaking, the pressure necessary for standard-pressure molding of the all-directional stretch materials is comparable to the pressure required to produce the same casting from high-impact shredded-canvas material. X-creped webs are also available for use in conjunction with low-pressure and bag-molding equipment.

For purposes of mold design a shrinkage of approximately 0.005 in. per in. should be allowed. In estimating, a gravity of approximately 1.4 should be assigned to these materials. In sheets or in die-cut form the X-creped materials have a bulk factor of approximately 4 to 1 which may be reduced by cold or low-temperature preforming pressure. In the case of coil charges the bulk is considerably less.

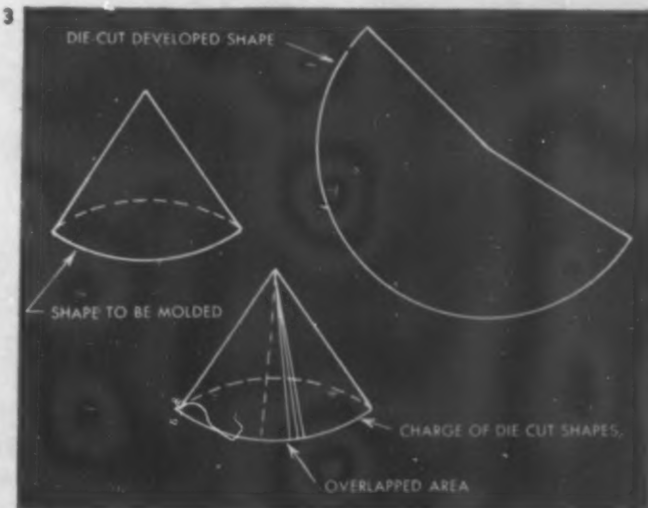
Castings of all-directional stretch creped materials can be readily machined, drilled and tapped. Where inserts are considered desirable they may be used as in standard molding practice. These X-creped materials are quite suited to the production of large castings with relatively thin wall thickness—applications which have always been somewhat of a problem to the molder. Since these materials are completely disposed over the molding surface when they are placed in the mold, tedious hand distribution of small piles of material over the molding surface and faulty weld lines are eliminated.

Preparation of molding charges

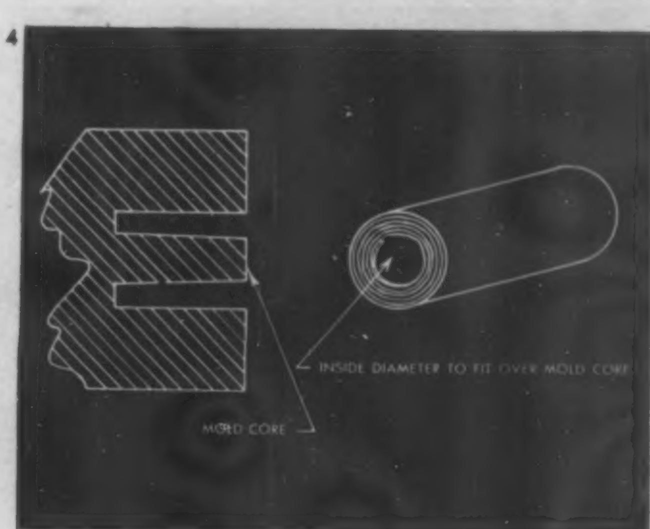
Both cloth and kraft materials are available in rolls and sheets, in die-cut form and as coil-charge preforms. When

3—The use of die cut shapes such as these enables the material to draw and flow into the contour of the mold. 4—Where the mold has a center core, as shown here, the coil charge is wound to fit around the core. 5—In this instance it was found more desirable to use a coil charge which had been collapsed before being placed in the mold

3



4



5

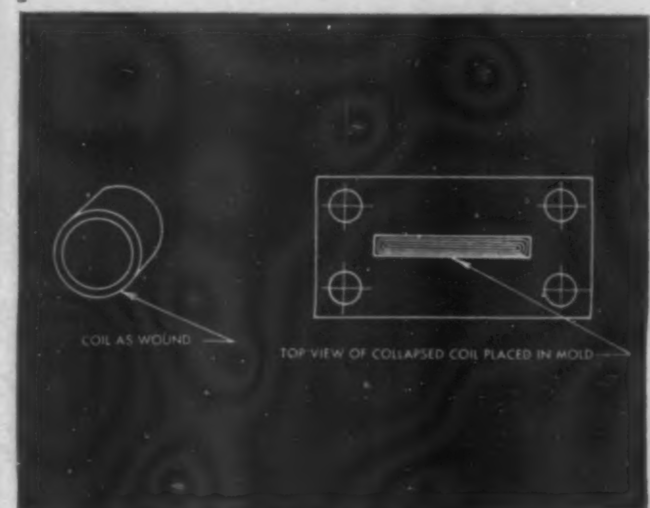


TABLE I.—PHYSICAL PROPERTIES[a]

Material[b]	*Water absorption*	*Dielectric strength, 1/8 in. thickness*	*Impact strength, Izod test*	*Modulus of elasticity*	*Flexural strength*	*Compressive strength*	*Tensile strength*	*Specific gravity*	*Rockwell hardness*
	percent	*short time volts per mil*	*ft.-lb./in. of notch*	*10^6 p.s.i.*	*p.s.i.*	*p.s.i.*	*p.s.i.*		
Kraft Resin X-crepe	0.5–1.0	230–300	1.0–1.5	0.60—0.90	13,000–15,000	23,000–38,000	10,000–12,000	1.40–1.42	M95–M110
Cloth Resin X-crepe	0.9–1.4	350–400	2.5–4.5	0.60—0.85	13,000–15,000	23,000–38,000	9,200–10,000	1.39–1.41	M95–M105

[a] The above table covers only two grades of Resin X-crepe material. Many of the values shown may be raised or lowered by changes in the grade of material. While these values are based on tests made in accordance with standard testing methods, they can in no way be warranted because values obtained from such tests are dependent not only on material used, but also on molding methods and conditions.
[b] Bulk factor: Die cut sheets—approx. 4 to 1; coil charges—approx. 2 to 1.

material is purchased in rolls or sheets it is usually necessary to die cut or wind the material in the molder's plant.

Die-cut forms are prepared by developing the shape of the object to be molded into a flat plane and cutting the material into these developed shapes. The method of developing such shapes is much the same as that used for developing sheet metal forms. After cutting, the die-cut forms are weighed out into individual charges—the established weight being that of the finished casting plus an allowance for flash and volatile loss. When the proper weight of die-cut forms has been made up, the stack of forms is placed in the mold so as to be evenly disposed over the molding surface. Then the press is closed. The closing may be under low or high pressure, depending on the nature of the piece and the molding conditions. As the mold is closed the die-cut forms draw and flow into the contour of the mold, and the result is a casting of continuously laminated structure. The use of die-cut blanks is illustrated in Fig. 3.

The die-cut pattern should be developed to permit some slight overlapping as it is brought into the shape of the object to be molded. It might be thought that this overlapping would result in maceration of the filler since the overlaps cause a concentration of pressure where they occur. However, this is not the case where X-creped materials are used. Since these materials possess the characteristic of flow, the X-crepe moves out from the areas of concentrated initial pressure into the areas of final pressure between the laps.

In many cases where the complexity of shape of the item to be molded is not too severe, it is possible to apply die-cut forms of simple character—circles or rectangles. For instance, where the draw in a shape such as that shown in Fig. 3 is not too deep, a stack of circles may be placed over the cavity and allowed to pleat in as the mold closes. Such pleating is occasioned by the fact that an excess of material exists in such circles over the amount of material which would be found in a corresponding developed pattern. The pleats are compressed as the mold closes and the excess material in the pleated areas flows into the area between the pleats.

The coil-charge preform is a ribbon of X-creped material, slit to a given width and wound to specified diameter and weight. Normally, a small tolerance is required on the weight and outside diameter of such charges. Where the mold has a center core, the coil charge is wound to fit around the core (Fig. 4). It is frequently found desirable to use a coil charge which has been collapsed, as indicated in Fig. 5.

It may be noted that in Figs. 4 and 5 the molding pressure is applied edgewise to the laminations, although in some cases the coil may be made up so that the pressure will be in the flatwise direction.

The obvious advantages of the coil-charge preform are ease in handling and the elimination of waste which normally accompanies a die-cutting operation. However, it should always be remembered that this type of charge is not suited to all applications.

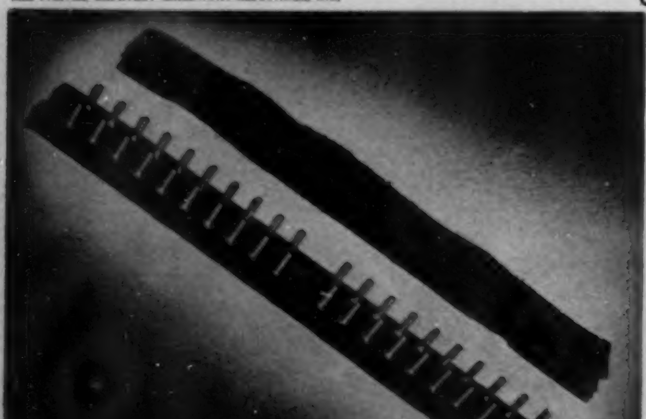
Standard test values

In designing a part, the average engineer depends very heavily upon data derived from standard tests in determining the suitability of a given material for a particular application. Unfortunately, standard plastic test specimens are of such

6 and 7—Two examples of molded shapes containing inserts and the charges which were used in producing them. The inserts are securely held by reason of the filler laminations moving into the scoring at the base of the insert

ALL PHOTOS, COURTESY CINCINNATI INDUSTRIES, INC.

6



7

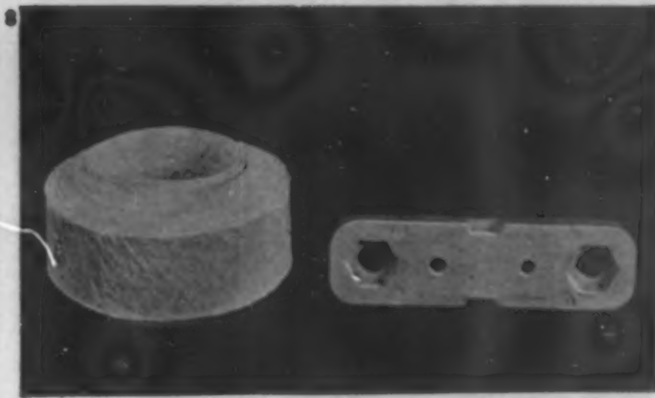
design that the results obtained from them do not necessarily indicate the true value of X-creped material after it has been molded into compound shapes. For example, when the standard test specimens are molded from a material containing a reinforcing filler, the filler is not required to flow, since the molding of such a piece is merely a straight compression of bulk. However, in molding a compound shape from such material, actual flow of the filler is required if the maximum strength is to be secured throughout the piece. This means that a new factor is introduced in the molding of compound shapes which was not present in forming the test specimens. Therefore, values secured from the test specimens may not necessarily hold true for the compound molded shapes.

In the case of all-directional stretch X-creped molding materials little, if any, of the stretchability of the reinforcing web is called into play in the molding of standard test pieces. However, when molded into an irregularly shaped part, the reinforcing web gives up its stretch and flows along with the resin so that in castings made from all-directional stretch fillers the reinforcing web is distributed continuously throughout the part.

From the foregoing it is evident that the true value of a molding material can only be determined by forming it into the part in question and then making comparative tests. In fact, it would seem that a long step forward would be made if the industry could develop a method of testing the various types of molding materials in shapes which would take into consideration their true values when molded into the irregular forms in which they will be used. Existing standard testing methods are inadequate because they do not take the actual finished form of the contemplated part into consideration.

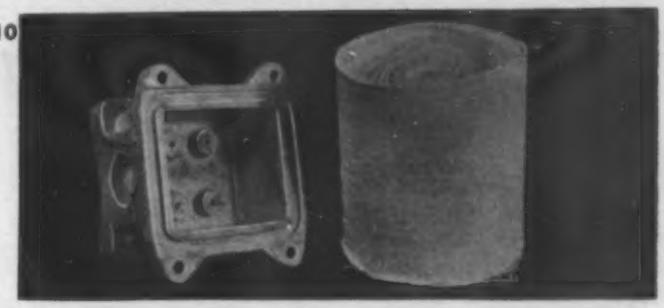
While current standard testing methods do not indicate the true values of X-creped all-directional stretch materials, many engineers feel that they should (*Please turn to page 192*)

8

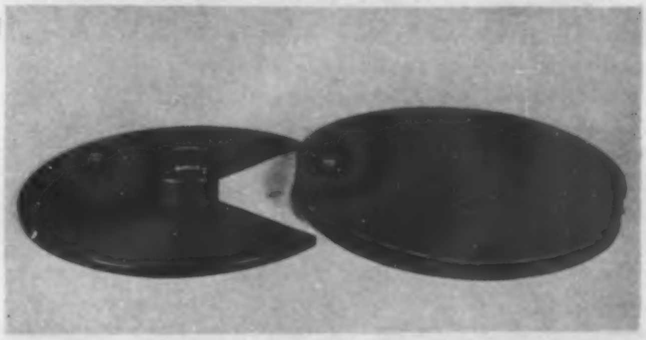


9

10



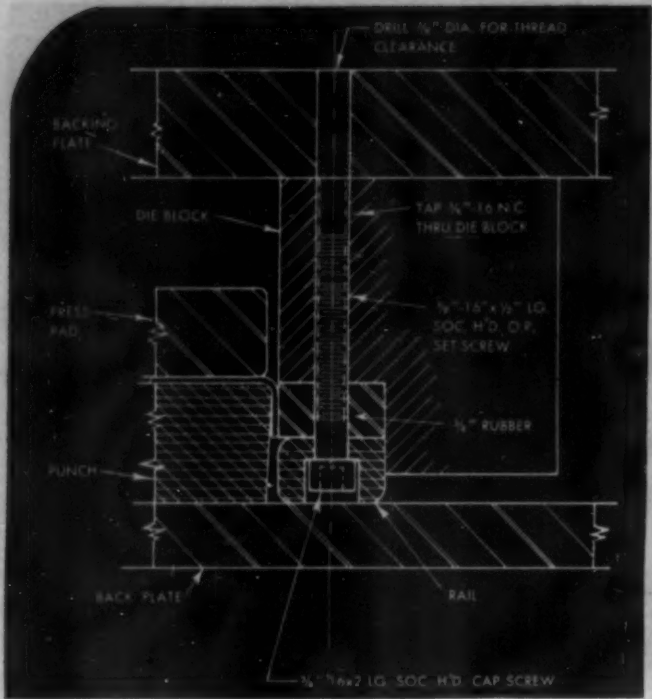
11



12

8 and 9—Further examples of parts which contain inserts and the X-creped charges employed for their molding. 10—This complicated molding is an excellent illustration of what can be done with X-creped cloth. 11—The mold casting shown here has been cut to expose the cross section. For this part, a wider coil was set within the large-diameter, narrow-width coil. 12—This piece was molded from a charge of rectangular sheets. The flow requirements in this case were extreme. 13—The part shown in this illustration was molded from die cut forms

13



1

2

Economical tooling of airplane parts

by DAVID A. COOK*

IN RECENT years considerable headway has been made in the adaptation of various plastic materials to the rapid and economical tooling of such short- and intermediate-run production as typical airplane parts. This type of tooling is not, however, restricted to aircraft work but is applicable to the production of a wider range of war and postwar articles.

While the advent of new materials and the wartime urge to reduce the time gap between design and production have encouraged the development of plastic tooling, these same conditions have also served to retard the general acceptance of these new methods. Consider the position of a chief tool engineer who is faced with the responsibility of meeting a 90-day schedule, timed from the release of a new project to the delivery of 10 assemblies per shift. He has been designing and buying hard tooling for 20 years. He is intimately acquainted with all the headaches in the manufacture and operation of these conventional tools. When approached by a plastics salesman concerning the advantages of plastic materials—for all functions, against all other tooling—it is but natural that this tooling engineer will show reluctance to risk the possible disruption of his close schedule in what is, to him, the experimental use of plastics for tooling.

Yet, bit by bit, factual data are being made available to the alert and responsible engineer on the successful uses—and on the limitations—of plastic materials. The following data on plastic tooling are admittedly the unsupported opinion of the writer. They represent his personal experience over a period of about three years in the design, fabrication and operation of various types of plastic tools, and his observation of the work of other fabricators.

Perhaps the oldest and best known use of plastics in tooling is the familiar hydro form blocks which are usually cut from flat laminated lignin sheets. One problem in such blocks has been swelling and delamination due to lubricant absorption and mechanical stress. However, a coat or two of die-stock hardener or similar impervious furfural or other hard surfacing appears to overcome this difficulty.

More recently, a series of metal-forming dies and die sets, largely constructed of laminated lignin sheets and adapted to use in mechanical presses, has been developed and placed in service.[1] Out of a group of fifty plastic dies now completing a long run, the majority have produced 5000 parts, the remainder 2500 parts—some under severe forming conditions. An average of only one minor rework was necessary on each die, and faulty construction was responsible for but four structural failures. A similar type of die, lacking the rubber closed-forming device, is in current use at the Naval Aircraft Factory.

A partial record of other mechanical press dies which the writer has observed in operation is as follows:

1. Five stretch blocks made of cast phenolic and using steel clamp rings. The blocks, with no reworks, turned out 7800 parts by the end of the run.

2. Eight draw dies each of which consists of a cast phenol punch and Meehanite draw rings. Eleven thousand cowl panels, 4 by 4 ft. in size, have been produced by one of these dies while the other dies have turned out from 3000 to 9000 panels. One die which, when dropped in handling, chipped so that a hole was left on the face, was repaired with resin in 4 hours and returned to service. When another of these tools jammed under the backing plate in the press, the 1-in. steel back-plate buckled and stripped the threads from one of the corner punches. The stripped threads were matrixed, and the run was completed. It is worthy of note that if a metal

* Consulting aero and production engineer, Airply Forming Co.

[1] Work being done by Cook Engineering Co.

3

4

die had been damaged in this manner it would probably have been sprung and thereby rendered useless.

3. Two draw dies made up of cast phenolic mating dies. Material clearance was obtained in these tools by differential (controllable) shrinkage between the punch and the die. The dies were made from a single net plaster pattern, and no trimming, grinding or fitting was required. No scoring or measurable wear was apparent after 11,000 oil scoops of 0.051-in. 24S0 Alclad had been drawn 9 in. deep over a plastic draw edge.

4. Forty piercing dies assembled from laminated phenolic backing plates, steel punches and die plates. Each of these dies, which has a practical size limit of about 2 by 2 ft.,[3] had a production of 2000 parts. From an entire run in which about 8,000,000 holes were pierced, only six punches were broken because of dimensional instability in the phenolic backing plates.

From a structural standpoint, the section properties of properly reinforced thermoplastics may be increased to a large degree at points of high stress and still leave a total tool weight of about $^1/_3$ or $^1/_4$ that of a metal tool. The only exception to the above statement exists at points where space is restricted—in narrow strippers or thin die projections. As far as surface hardness is concerned, most plastics will score under conditions of metal forming involving actual coining of metal. This difficulty can, however, be overcome by the use of a metal insert. In addition, plastics possess a tough, springy quality that apparently outwears the zinc alloys up to the point at which metal is actually coined and, under the most severe conditions, Alclad is not marked by plastics.

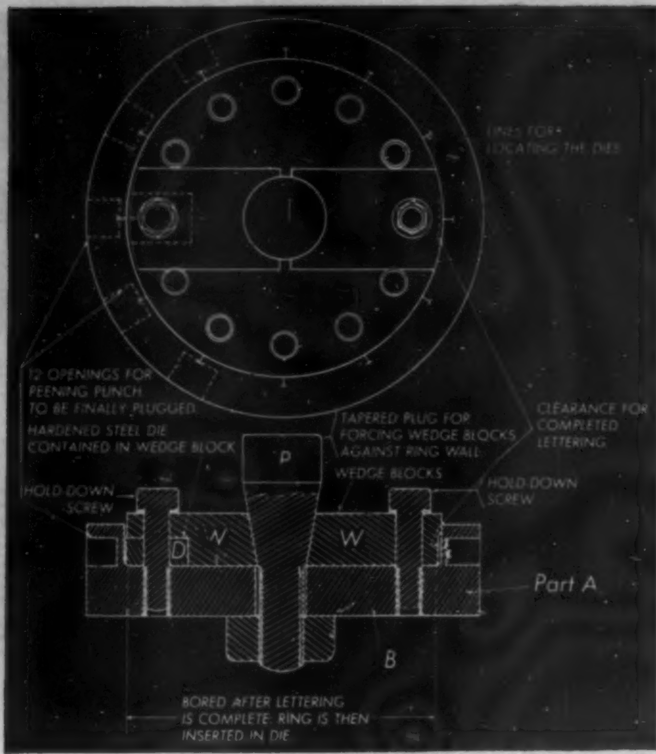
The first cost of cast-resin dies is invariably less than for cast-metal dies. Material cost per unit weight averages about 40 cents per lb. for phenolic casting resin, 30 cents for zinc alloy and 15 cents for Meehanite. Since phenolic resin is lighter in weight than the metals mentioned above, it has greater bulk per pound. As a result, fewer pounds of plastic are required in the forming of a given number of tools, thereby rendering the material costs of (*Please turn to page 206*)

[3] "Basic Advantages of All-plastic Dies and Die-sets," Aero Digest *44*, 106 (Feb. 1, 1944).

5

1—This blueprint shows a typical assembly draw rail to die block. 2 Some typical aircraft parts and the blanks from which they were formed. 3 and 4 Typical plastic forming dies. The ease with which these dies can be handled is evident in these illustrations. 5 These parts are shown exactly as they were struck without any hand working having been done on them

1



DRAWING, COURTESY PLASTIC MOLDING CORP. 2

1—Although this 8-in. disk appears to be a relatively simple part, the markings on its outside periphery presented molding difficulties. 2—This drawing shows the tooling set-up designed to raise the numerals and markings in the ring

Molding undercut markings

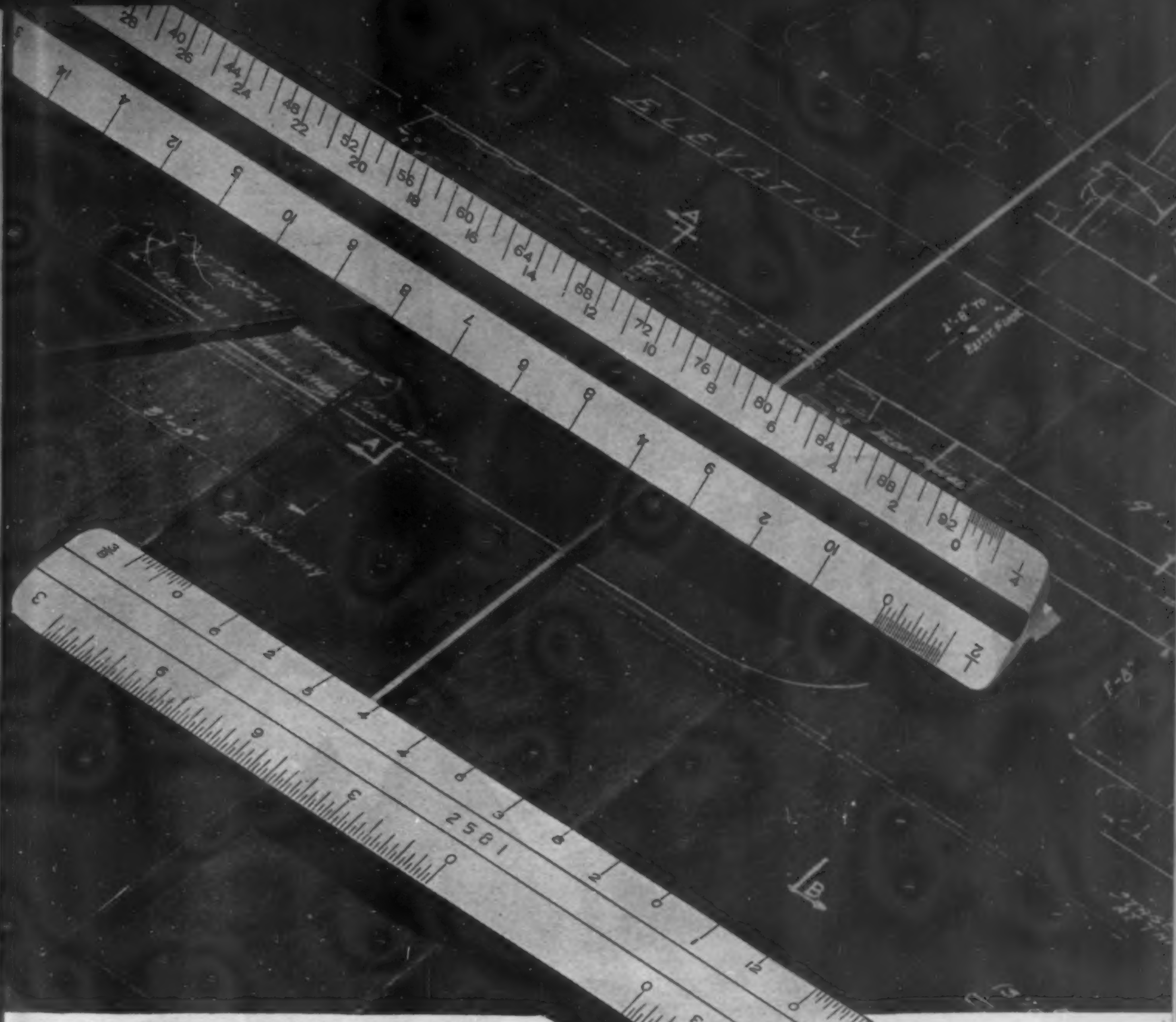
An 8-in. disk, 1/2 in. thick at the outside diameter, does not ordinarily present molding difficulties. However, when a Cincinnati molding company undertook the production of the part shown in Fig. 1, complete with depressed letters on its outside periphery, it knew that it was faced with more than a molding problem. This disk has four ribs on its lower face which not only support the flat top surface but also help reduce warping. A 1 3/8-in. round boss pierced with a 5/8-in. square mounting hole completes the details of this unit.

Requirements on this part do not allow the appearance of any split lines on the outside periphery; and split lines would obviously be in evidence if loose plugs were employed for the molding of the numbers. To overcome this difficulty, it was decided to use the inside diameter of a one-piece steel ring for the molding of the outside periphery surface of the disk, and to raise the 12 sets of numbers and markings on the molding surface of this circular metal band. There remained the problems of removing the molded plastic disk with its depressed letters from this one-piece ring and of raising the numerals and markings on the ring.

Because of the diameter of this molded part—approximately 8 in.—it was decided that the natural shrinkage of the plastic would permit the depressed letters to disengage from the mold. As the specifications call for all the markings to be depressed a minimum of 0.032 in., it was necessary that a material be selected with the minimum cold-mold to cold-piece shrinkage of 0.008 in. per in., which would give a total over-all shrinkage of 0.064 inch. Any material with less shrinkage would leave some part of these undercut numbers still engaged with the mold, and it would be impossible to remove the mold piece without a consequent tearing and ruining of the engraving.

The second problem—that of raising the numerals and markings on the ring—was solved by the very novel method shown in Fig. 2. To engrave the inside of the steel number ring properly, part A in the section view was first cut to size. Twelve hardened steel dies (D) were then tooled up and engraved with the desired numbers, and one of the wedge blocks (W) was recessed so that it would receive one of the two hardened dies. Twelve positions, corresponding to the points where markings were specified on the molded disk, were then carefully marked off on the one-piece steel ring, 30° apart. In the next operation, 12 openings, each centered at the designated 30° position, were drilled in the ring from the outside (Fig. 2). Care was taken to leave approximately 1/8 in. of material between the bottom of each hole and the inside diameter of the ring.

The wedge blocks with a die in position in one of the blocks, were then located inside of the steel ring (Fig. 2). After a tapered plug (P) had forced the blocks tight against the inside ring wall, hold-down screws were used to lock the blocks and die in position. The tapered plug itself was locked in position with a large nut. There followed a simple peening operation which drove some of the material left at the bottom of each of the 12 outside openings into the engraving in the dies. This peening operation was continued until the numbers were brought up clear and (*Please turn to page 190*)



Tenite scales molded by American Molding Co. for A. Lietz Co.

Effect of environmental conditions on cellulose acetate and nitrate sheets*

by T. S. LAWTON, JR., T. S. CARSWELL and H. K. NASON†

FOR the intelligent engineering application of any material, a knowledge of its properties under all environmental conditions which may be encountered in service is essential. Data of this type for plastics have been scarce but are being accumulated rapidly to aid in the design of military equipment. A summary of recent progress in this field has been published recently from this laboratory.[1]

The work reported herewith was undertaken to fill in gaps in our knowledge of the behavior of cellulose acetate and cellulose nitrate plastic sheets over the ranges of temperature and humidity ordinarily encountered in engineering uses.

Materials

The cellulose acetate sheets used in this investigation were 2050 TVA Fibestos, of the same composition as the materials used by Findley.[2, 3, 4] They were manufactured by the sheeter process,[5, 6] and the surfaces were given an "HH" (polished) finish in a planish press under the conditions customarily employed for such materials. The content of residual solvent and water was less than 1.5 percent as received. These materials are of the type customarily furnished for transparent enclosures on aircraft[7] and similar applications, and they meet all requirements of Air Corps Specification 12025-B,[8] Navy Aeronautical Specification P-41c[9] and A.S.T.M. Specification D 786 – 44 T.[10]

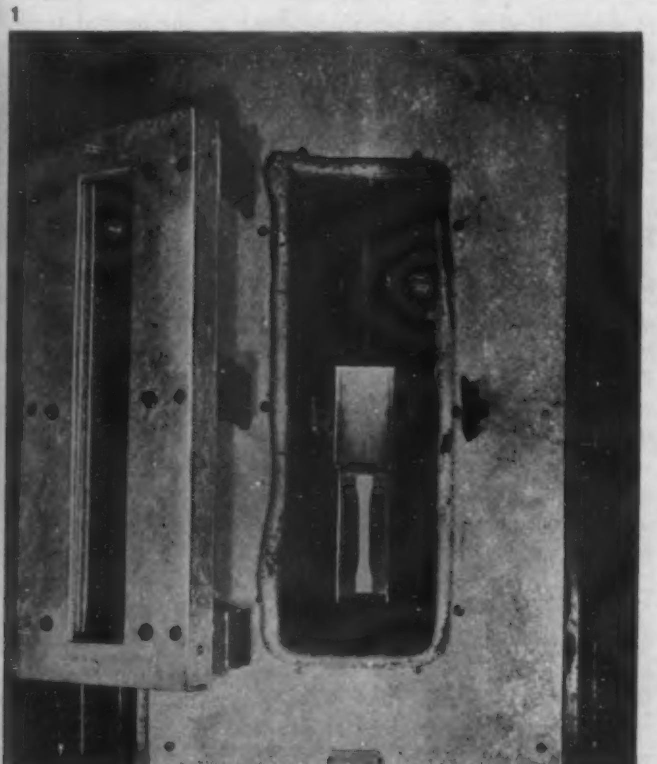
The cellulose nitrate sheets were manufactured from medium-viscosity pyroxylin of approximately 11.0 percent nitrogen content, and were plasticized with camphor. Detailed compositions of specific materials are shown in the sections which follow. Processing was by the sheeter method and was similar to that employed for the cellulose acetate sheets. Residual solvent and water content was less than 1.0 percent as received. These materials meet all requirements of A.S.T.M. D 701 – 44 T, Type 1,[11] U. S. Army Specification 94-12008B[12] and also of the Federal Specification

* Presented before the Rubber and Plastics Division at the semi-annual meeting of the American Society of Mechanical Engineers, Pittsburgh, Pa., on June 22, 1944.

† Research Dept., Monsanto Chemical Co.

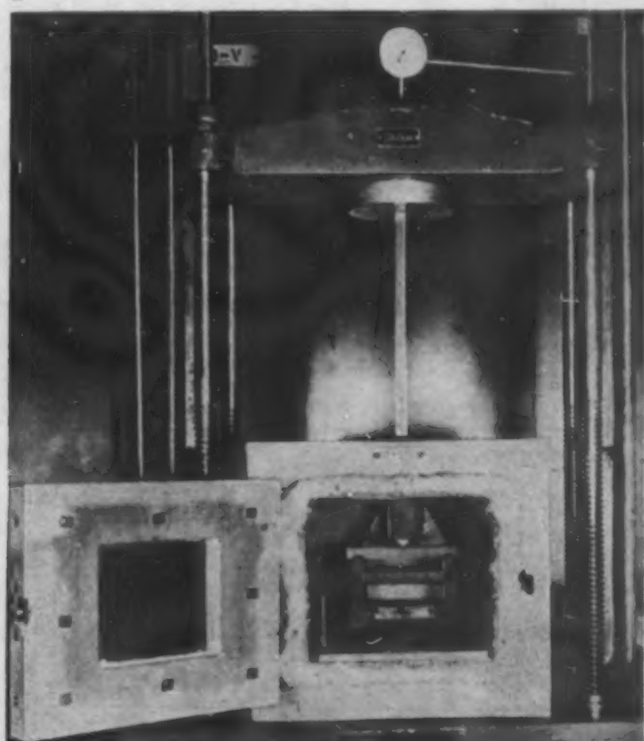
1—*Apparatus used for tensile test*

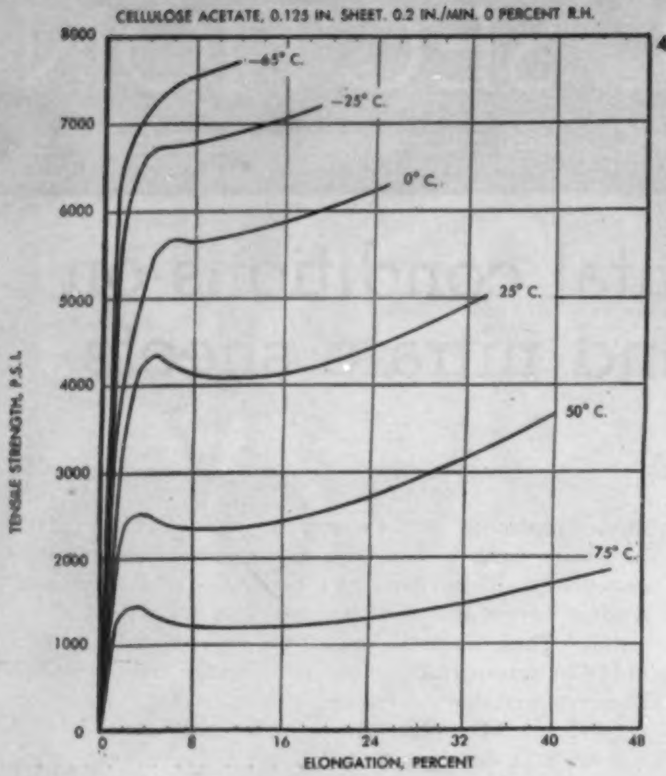
1



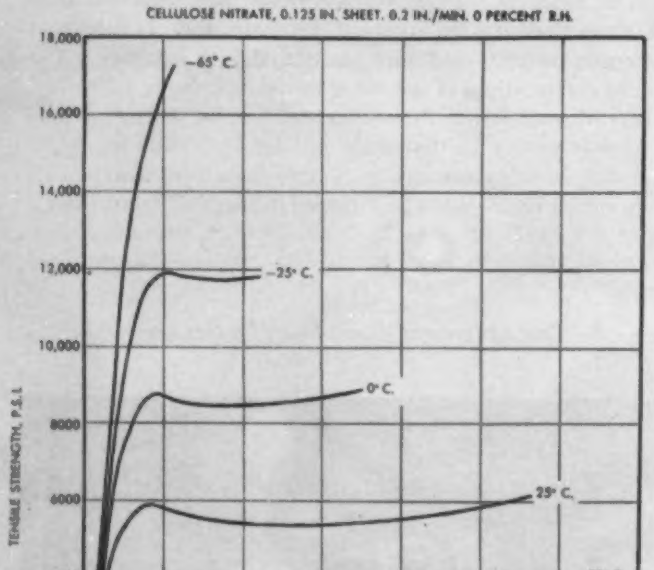
2—*This equipment is employed for flexural tests*

2

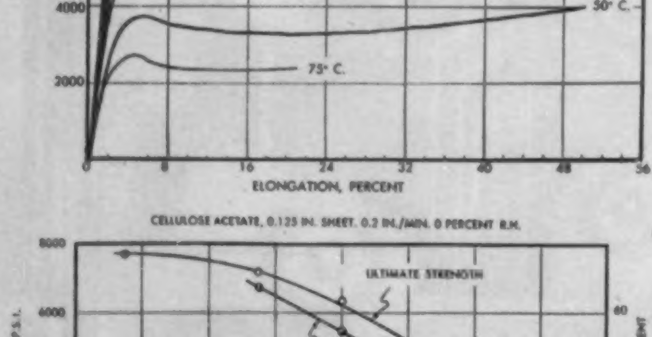




4



5



6


3

3—Apparatus for impact tests. 4—Stress-strain curves for cellulose acetate sheet at various temperatures. 5—Stress-strain curves for cellulose nitrate sheet at various temperatures. 6—Effect of temperature on tensile properties of cellulose acetate sheet plastic. 7—Effect of temperature on tensile properties of cellulose nitrate sheet plastic. 8—Effect of temperature on elastic moduli of cellulose acetate sheet plastic. 9—Effect of temperature on elastic moduli of cellulose nitrate sheet plastic. 10—This chart shows effect of temperature on the yield stress of cellulose acetate sheet plastic

GG-T-G71.[13] All materials used for these tests were taken from regular production lots.

Test procedures

The desired number of test specimens were cut from a single plastic sheet and mixed thoroughly to minimize geometric variables. All samples were preconditioned for 48 hr. at 50° C. (122° F.) to eliminate moisture, and were stored in a desiccator over anhydrous calcium chloride until needed. For testing at various temperatures, specimens were placed in a conditioning chamber maintained at the desired temperature and allowed to remain for at least 6 hr. to insure thermal equilibrium. They were then transferred quickly to a conditioned chamber on the testing apparatus, through which dry air at the desired temperature was circulating, and allowed to stand at least 10 min. to insure that thermal equilibrium was restored. The test was then made under the desired conditions.

A similar procedure was followed for testing at various humidity conditions except that samples were allowed to stand for at least 6 days in the conditioning chamber. All tests under varying humidity conditions were made at 25° C. (77° F.). The type of apparatus used for tensile and shear tests is shown in Fig. 1, that for flexural and compressive tests in Fig. 2 and that for impact tests in Fig. 3. Reported values represent the arithmetical mean of at least five determinations, and the plus or minus limits that are shown represent the arithmetical mean deviation of the individual values from the mean.

Tensile properties

Tensile properties were determined by the method specified in A.S.T.M. Designation D 638 - 44 T;[14] the method specified by Federal Specification L-P-406a[15] is identical. Stress-strain data were determined at a crosshead speed of 0.20 in. per minute.

Table I.—Effect of Temperature on Tensile Properties of 0.125-In.-Thick Cellulose Sheet Plastics[a]

Temperature °C.	Temperature °F.	Modulus of elasticity 10^5 p.s.i.	Yield stress p.s.i.	Tensile strength p.s.i.	Elongation percent
Cellulose acetate plastic					
−65	−85	5.52 ± 0.03	....	7,690 ± 28	12 ± 1
−25	−13	3.98 ± 0.04	6,730 ± 80	7,190 ± 100	19 ± 1
0	32	3.00 ± 0.02	5,500 ± 160	6,380 ± 120	34 ± 2
25	77	2.60 ± 0.02	4,180 ± 60	4,980 ± 100	34 ± 3
50	122	2.01 ± 0.02	2,510 ± 80	3,260 ± 80	40 ± 3
75	167	1.81 ± 0.01	1,410 ± 40	1,670 ± 92	46 ± 4
Cellulose nitrate plastic					
−65	−85	3.28 ± 0.01	......	17,900 ± 600	9.3 ± 1.0
−25	−13	2.66 ± 0.02	10,100 ± 300	11,950 ± 60	18 ± 2
0	32	2.22 ± 0.01	7,690 ± 130	8,850 ± 150	28 ± 3
25	77	2.02 ± 0.02	5,390 ± 80	6,100 ± 180	45 ± 4
50	122	1.60 ± 0.02	3,380 ± 100	4,050 ± 60	50 ± 2
75	167	1.39 ± 0.02	2,300 ± 40	2,360 ± 120	25 ± 2

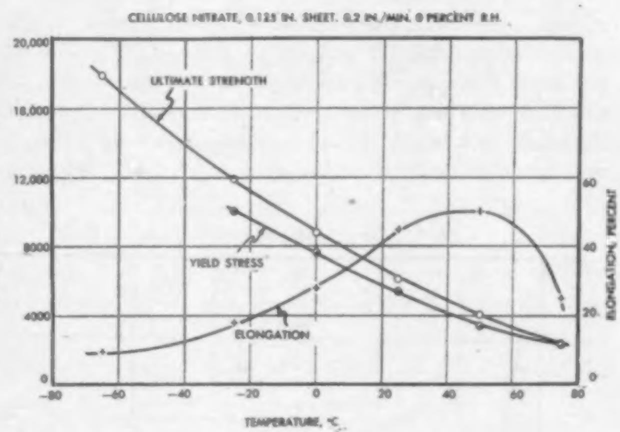
[a] Specimens preconditioned 48 hr. at 50° C. (122° F.) and stored in a desiccator. Tested at 0.2 in. per min. crosshead speed.

Effect of temperature.—Stress-strain curves for cellulose acetate at temperatures ranging from −65° C. (−85° F.) to 75° C. (167° F.) are shown in Fig. 4, and similar data for cellulose nitrate are shown in Fig. 5. Both acetate and nitrate sheet plastics were 0.125 in. thick, and the nitrate sheet contained approximately 25 percent camphor. The effects of temperature on the modulus of elasticity, yield stress, tensile strength and elongation (at break) of the cellulose acetate and cellulose nitrate sheet plastics are summarized in Table I and Figs. 4 to 11.

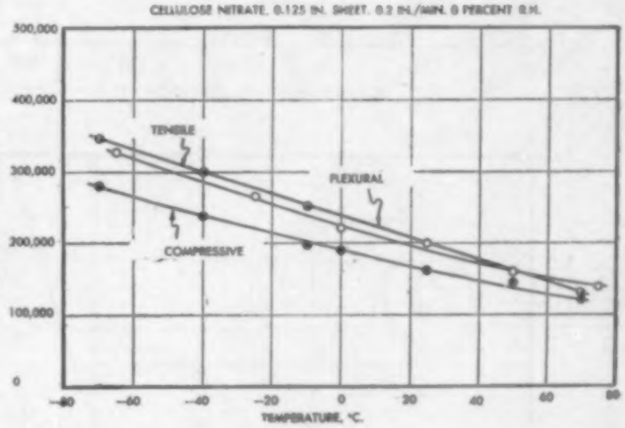
Effect of humidity.—The effect of relative humidity at 25° C. on the tensile strength and elongation of cellulose acetate and cellulose nitrate sheet plastics is summarized in Table II and shown graphically in Fig. 12. The moisture content of these plastics, when in equilibrium with atmospheres at various relative humidities, was determined chemically by the Karl Fischer method.[16] Specimens 0.010 in. thick were used, and the water content was determined after 8 days' exposure at the desired humidity level. The results are summarized in Table III, and shown graphically in Fig. 13.

Effect of sheet thickness.—To determine the effect of sheet thickness on tensile strength of cellulose acetate, a series of

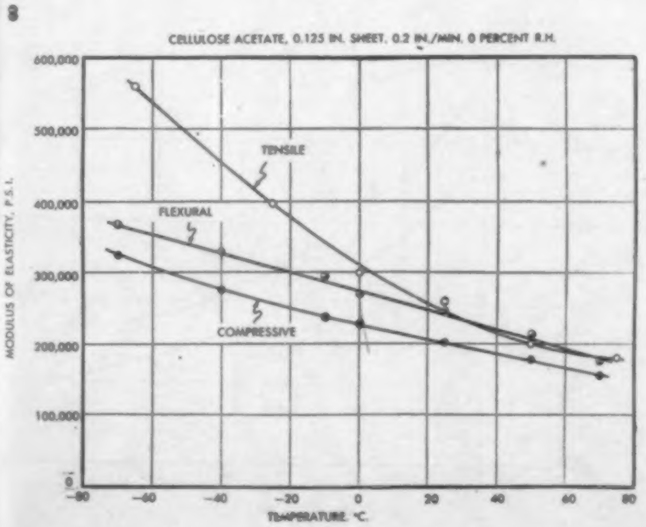
7



9



8



10

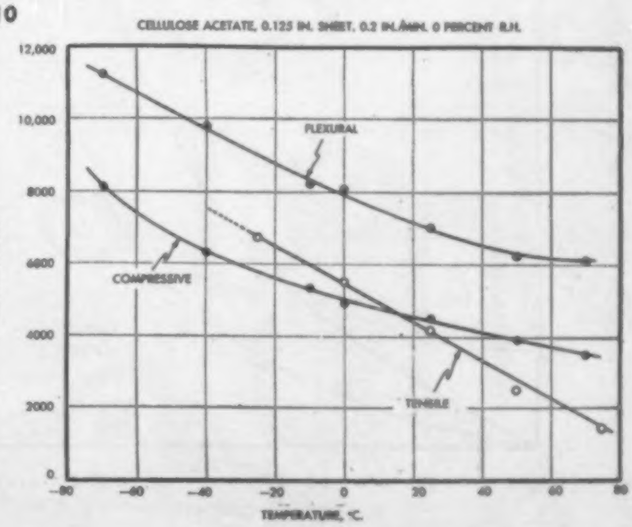


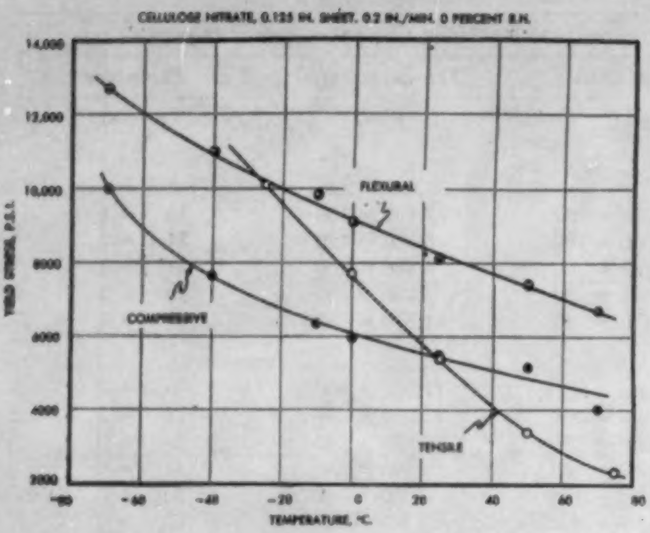
Table II.—Effect of Relative Humidity on Tensile Properties of Cellulose Sheet Plastics

Relative humidity at 25° C. (77° F.)	*Tensile strength*	*Elongation*
percent	*p.s.i.*	*percent*
Cellulose acetate plastic		
0	4980 ± 100	34 ± 3
25	4710 ± 50	38 ± 1
50	4480 ± 90	41 ± 1
70	4230 ± 110	45 ± 1
88	4030 ± 50	48 ± 1
Cellulose nitrate plastic		
0	6100 ± 180	45 ± 4
25	5660 ± 40	47 ± 1
50	5490 ± 80	50 ± 1
70	4770 ± 60	53 ± 1
88	4600 ± 50	56 ± 1

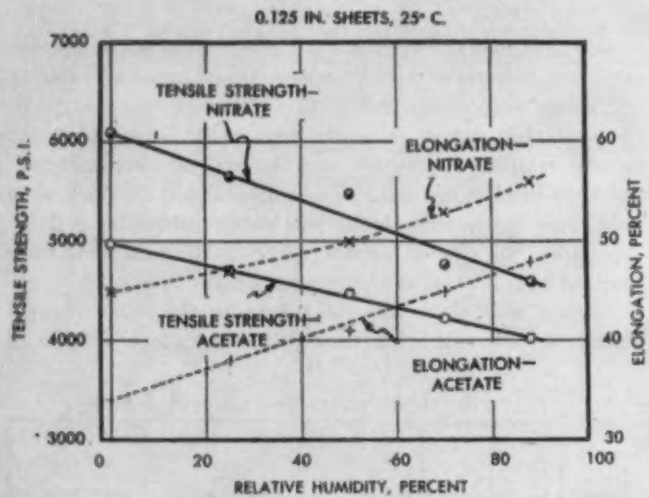
sheets varying in thickness from 0.010 to 0.250 in. were skived from the same block of plastic, thoroughly seasoned to remove volatile solvents and finished by planishing. A series of cellulose nitrate sheets were prepared in a similar manner except that not all were cut from the same block of plastic. Tensile specimens were cut from these sheets, conditioned for several weeks at 25° C. (77° F.) and 50 percent relative humidity, and tested at these conditions by the standard method (A.S.T.M. D 638 - 44 T). A crosshead speed of 0.20 in. per min. was employed. The results are summarized in Table IV and shown graphically in Fig. 14.

Effect of testing speed.—Standard test specimens, conditioned and tested at 25° C. (77° F.) and 50 percent relative humidity, were broken in tension at four different crosshead speeds—0.05, 0.20, 1.0 and 4.0 in. per minute. The cellulose acetate specimens were from three sheets—0.060, 0.125 and 0.250 in. thick, respectively—all of which were cut from the same block of plastic and finished in the same way. This was, however, a different lot of material than the one used

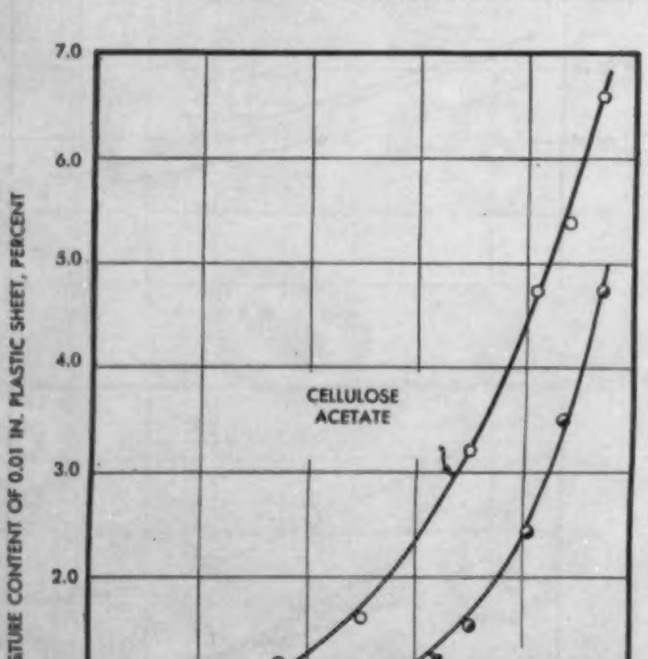
11



12



13



14

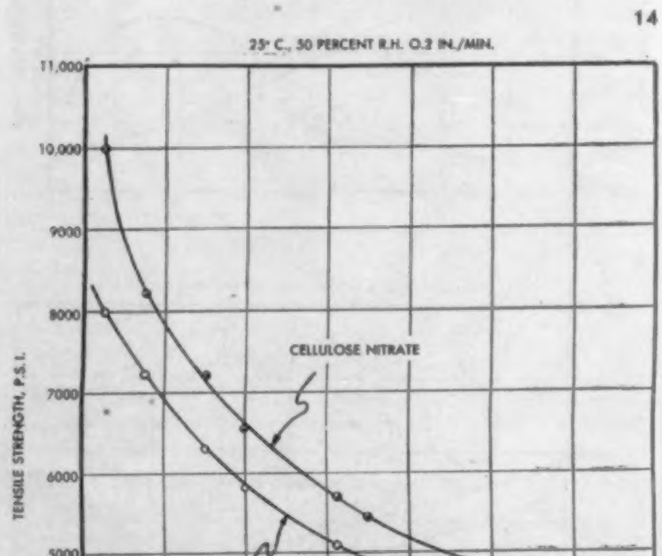


Table III.—Moisture Content of 0.010-In.-Thick Cellulose Sheet Plastics at Various Humidity Equilibria

Relative humidity at 25° C. (77° F.)	*Moisture content of cellulose acetate*	*Moisture content of cellulose nitrate*
percent	*percent*	*percent*
35	1.17 ± 0.06	0.54 ± 0.02
50	1.63 ± 0.05	0.77 ± 0.06
70	3.21 ± 0.15	1.56 ± 0.09
81	......	2.46 ± 0.12
82	4.73 ± 0.10	......
87	......	3.49 ± 0.13
88	5.36 ± 0.14	......
94	6.61 ± 0.17	4.74 ± 0.12

for the other tensile tests reported above, although its composition was the same. Approximate initial rate of stressing was calculated by the method described in A.S.T.M. Designation D 638 - 42 T.[14] The results of these tests are summarized in Table V. The effect of testing speed on tensile strength of the three thicknesses of acetate sheet is shown graphically in Fig. 15, and the effect on tensile strength, elongation and reduction in area of the 0.060 in. sheet is shown in Fig. 16.

Data on the effect of testing speed on tensile strength and elongation of two different cellulose nitrate plastics are summarized in Table VI and shown graphically in Fig. 17. Both of these materials differed in composition from the sheets used for the other tensile tests reported above. Plastic A contained approximately 22.5 percent of a mixture of camphor and an alkyl phthalate, and the sheets were 0.150 in. thick. Plastic B contained approximately 24.5 percent of camphor, and the sheets were 0.140 in. thick. *(Please turn to next page)*

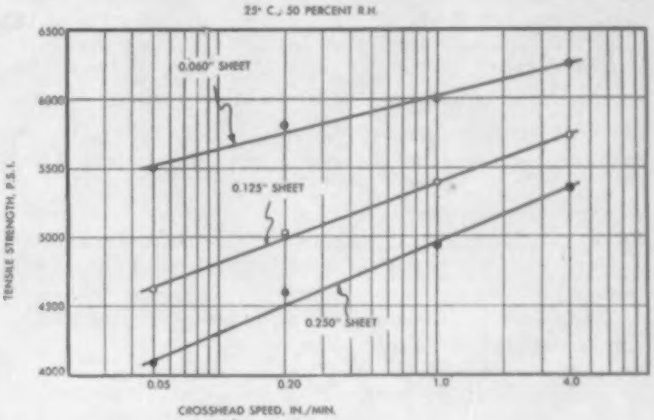
11—Effect of temperature on yield stress of cellulose nitrate sheet. 12—Effect of relative humidity on tensile properties of cellulose acetate and cellulose nitrate sheet plastics. 13—Moisture absorption of cellulose acetate and nitrate sheets at various humidities. 14—Effect of thickness on tensile strength of these two plastic sheets. 15—Effect of testing speed on tensile strength of three thicknesses of cellulose acetate sheet. 16—Effect of testing speed on tensile strength of 0.060 in. cellulose acetate

Table IV.—Effect of Thickness on Tensile Strength of Cellulose Sheet Plastics[a]

Thickness of sheet	*Tensile strength of cellulose acetate*	*Tensile strength of cellulose nitrate*
in.	*p.s.i.*	*p.s.i.*
0.010	7990 ± 160	10,000 ± 120
0.030	7210 ± 70	8,210 ± 90
0.060	6310 ± 160	7,200 ± 140
0.080	5820 ± 90	6,570 ± 90
0.125	5100 ± 110	5,700 ± 100
0.140	5450 ± 60	....
0.180	....	4,500 ± 90
0.240	4700 ± 90	....
0.250	....	4,030 ± 60

[a] Specimens conditioned and tested at 25° C. (77° F.) and 50 percent relative humidity. Tested at 0.2 in. per min. crosshead speed.

15



16

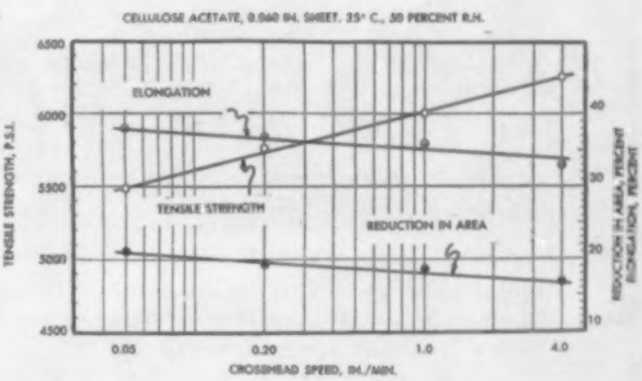
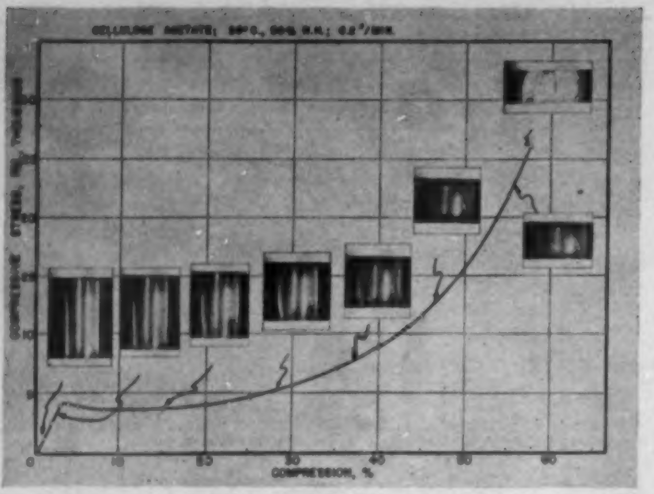


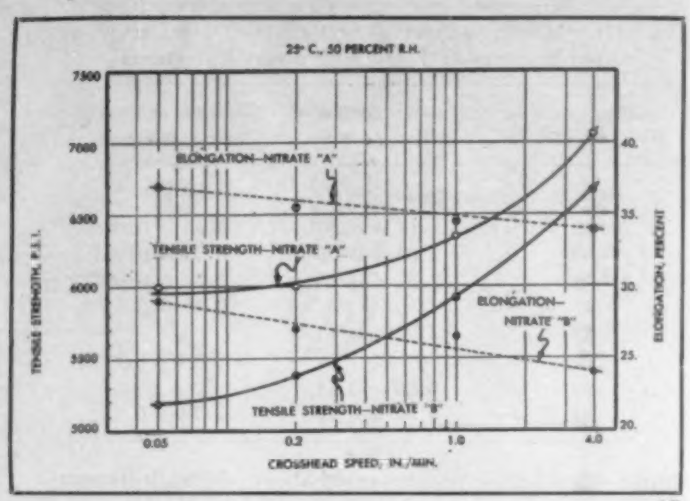
Table V.—Effect of Testing Speed on Tensile Properties of Cellulose Acetate Sheet Plastic[a]

Thickness of sheet	*Crosshead speed*	*Approximate initial rate of stressing*	*Tensile strength*	*Elongation*	*Reduction in area*
in.	*in./min.*	*p.s.i./min.*	*p.s.i.*	*percent*	*percent*
0.060	0.05	1,810	5490 ± 140	38 ± 2	21.2 ± 0.9
0.060	0.20	7,820	5770 ± 170	37 ± 2	19.3 ± 2.1
0.060	1.0	41,900	6010 ± 260	36 ± 2	18.7 ± 2.7
0.060	4.0	186,000	6260 ± 150	33 ± 4	16.9 ± 1.4
0.125	0.05	1,600	4620 ± 170	37 ± 3	20.4 ± 2.1
0.125	0.20	6,710	5000 ± 240	38 ± 3	20.2 ± 1.4
0.125	1.0	35,600	5350 ± 300	34 ± 5	17.6 ± 2.6
0.125	4.0	156,000	5720 ± 80	38 ± 2	19.0 ± 1.0
0.250	0.05	1,470	4090 ± 160	42 ± 2	22.1 ± 0.7
0.250	0.20	6,180	4550 ± 90	43 ± 2	22.0 ± 0.9
0.250	1.0	32,700	4890 ± 130	44 ± 2	22.6 ± 1.5
0.250	4.0	147,000	5350 ± 100	46 ± 2	20.4 ± 1.7

[a] Specimens conditioned and tested at 25° C. (77° F.) and 50 percent relative humidity.



18



17

17—This chart shows the effect of testing speed on the tensile properties of cellulose nitrate sheet plastic. 18—This combination graph and halftone gives typical compressive stress-strain curve for cellulose acetate

Table VI.—Effect of Testing Speed on Tensile Properties of 0.140-In.-Thick Cellulose Nitrate Sheet Plastic[a]

Cellulose nitrate plastic[b]	*Crosshead speed*	*Tensile strength*	*Elongation*
	in./min.	*p.s.i.*	*percent*
A	0.05	6000 ± 120	37 ± 1
A	0.20	6000 ± 280	35 ± 4
A	1.0	6350 ± 130	34 ± 3
A	4.0	7070 ± 100	34 ± 7
B	0.05	5190 ± 300	29 ± 3
B	0.20	5380 ± 180	27 ± 3
B	1.0	5920 ± 220	26 ± 3
B	5.0	6670 ± 40	24 ± 4

[a] Specimens conditioned and tested at 25° C. (77° F.) and 50 percent relative humidity.
[b] Plasticizer contents of these plastics were as follows: A: 22.5 percent of a mixture of camphor and an alkyl phthalate. B: 24.5 percent of camphor.

Table VII.—Effect of Temperature on Compressive Properties of Cellulose Sheet Plastics[a]

Temperature		*Modulus of elasticity*	*Compressive yield stress*
° C.	*° F.*	*10^5 p.s.i.*	*p.s.i.*
Cellulose acetate plastic			
−70	− 94	3.24 ± 0.01	8340 ± 150
−40	− 40	2.76 ± 0.02	6300 ± 70
−10	14	2.39 ± 0.01	5310 ± 60
0	32	2.31 ± 0.01	4900 ± 80
25	77	2.03 ± 0.02	4470 ± 40
50	122	1.78 ± 0.01	3900 ± 60
70	158	1.56 ± 0.02	3510 ± 60
Cellulose nitrate plastic			
−70	− 94	2.81 ± 0.02	10,000 ± 160
−40	− 40	2.39 ± 0.01	7650 ± 110
−10	14	1.98 ± 0.01	6340 ± 220
0	32	1.90 ± 0.02	5960 ± 60
25	77	1.63 ± 0.02	5480 ± 60
50	122	1.45 ± 0.04	5170 ± 80
70	158	1.20 ± 0.02	4000 ± 130

[a] Specimens 0.5 × 0.5 × 1.0 in. were preconditioned 48 hr. at 50° C. (122° F.), stored in a desiccator and tested at 0.2 in. per min. crosshead speed.

Compressive properties

Compressive properties were determined by the method specified in A.S.T.M. Designation D 695 – 42 T.[17] The test specimens, cut from the same materials used for the tensile tests described above, were formed by laminating $^1/_2$-in. wide strips in a press to form 0.5 × 0.5-in. bars from which prisms 0.5 × 0.5 × 1 0 in. were cut for use as test specimens. These were tested at a crosshead speed of 0.20 in. per minute. Compressive yield stress was taken as the point of failure since beyond this the specimens deformed continuously until they were smashed to a thin cake. A typical compressive stress-strain curve for cellulose acetate at 25° C. and 50 percent relative humidity is shown in Fig. 18; the photographs show the appearance of the test specimens at various points on the curve.

The data for both acetate and nitrate sheets are summarized in Table VII. The effect of temperature on modulus of elasticity is shown graphically in Figs. 8 and 9, and on yield stress in Figs. 10 and 11, respectively.

Flexural properties

Flexural properties were determined by the method described in A.S.T.M. Designation D 650 – 42 T.[18] The test

Table VIII.—Effect of Temperature on Flexural Properties of Cellulose Sheet Plastics[a]

Temperature		*Modulus of elasticity*	*Maximum fiber stress at yield*
° C.	*° F.*	*10^5 p.s.i.*	*p.s.i.*
Cellulose acetate plastic			
−70	− 94	3.68 ± 0.06	11,200 ± 110
−40	− 40	3.30 ± 0.04	9810 ± 70
−10	14	2.95 ± 0.02	8210 ± 80
0	32	2.70 ± 0.04	8070 ± 80
25	77	2.46 ± 0.02	7000 ± 120
50	122	2.15 ± 0.03	6220 ± 60
70	158	1.76 ± 0.02	6120 ± 40
Cellulose nitrate plastic			
−70	− 94	3.47 ± 0.02	12,700 ± 90
−40	− 40	3.01 ± 0.02	11,000 ± 400
−10	14	2.53 ± 0.03	9820 ± 60
0	32	2.24 ± 0.03	9100 ± 70
25	77	2.00 ± 0.04	8090 ± 60
50	122	1.62 ± 0.03	7390 ± 60
70	158	1.31 ± 0.02	6700 ± 40

[a] Specimens preconditioned 48 hr. at 50° C. (122° F.) and stored in a desiccator. Tested at 0.2 in. per min. crosshead speed.

Table IX.—Effect of Temperature on the Shear Strength of Cellulose Sheet Plastics[a]

Temperature		Shear strength of cellulose acetate	Shear strength of cellulose nitrate
° C.	° F.	p.s.i.	p.s.i.
−70	−94	6190 ± 70	6670 ± 20
−40	−40	5750 ± 30	6040 ± 40
−25	−13	5570 ± 40	5800 ± 60
0	32	5320 ± 50	5550 ± 90
25	77	5100 ± 130	5320 ± 50
50	122	4860 ± 30	5100 ± 50
70	158	4490 ± 60	4660 ± 70

[a] Specimens preconditioned 48 hr. at 50° C. (122° F.) and stored in a desiccator. Tested at 0.2 in. per min. crosshead speed.

specimens cut from the same materials used for the tensile tests described above, were formed by laminating four 0.5 × 0.125 × 5-in. strips in a press to form a 0.5 × 0.5 × 5.0-in. test bar. These were tested edgewise with a span of 4 in. and at a crosshead speed of 0.20 in. per minute. Maximum fiber stress at the yield point was taken as the criterion of failure since beyond this point the specimen deflected continuously, with no increase in load, until the ends slipped through the supports.

The data for both acetate and nitrate sheets are summarized in Table VIII. The effect of temperature on modulus of elasticity is shown graphically in Figs. 8 and 9, and the effect on yield stress is shown in Figs. 10 and 11, respectively.

Shear properties

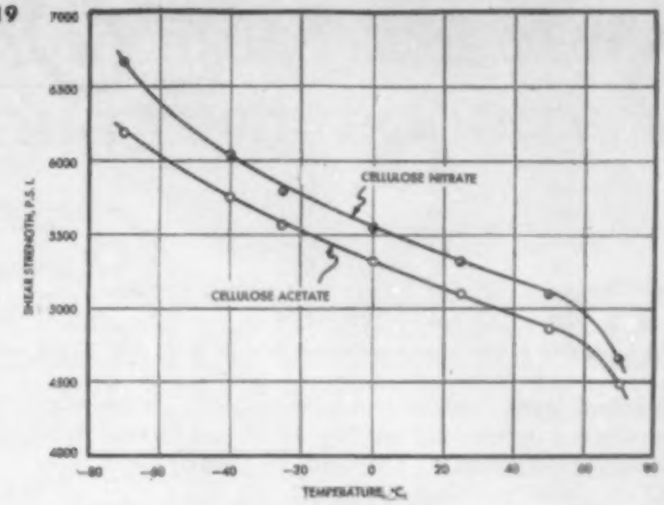
Shear strengths were determined by the method described in Federal Specification L-P-406a.[15] The 3-plate shear tool was used with pins 0.375 in. in diameter and 1 in. long. These pins were turned on a lathe from 0.5 × 0.5-in. bars, formed by laminating four 0.125 × 0.5-in. strips in a press. The materials were the same as those used in the tensile tests described above. Testing speed was 0.20 in. per minute, and the results are calculated for "single" shear, i.e., the shearing stress existing at *each* point of failure. These stresses are one-half of the so-called "double" shear stresses obtained by dividing breaking load by cross-sectional area of the pins. The data for both acetate and nitrate sheets are summarized in Table IX, and are shown graphically in Fig. 19.

Impact properties

Impact properties were determined by both Charpy and Izod methods, in accordance with the procedures described in A.S.T.M. Designation D 256 - 43 T.[19] Specimens 0.125 in. thick, 0.5 in. wide, and of the proper length, were notched with a single-tooth milling cutter at 4000 rpm. and were bound together in groups of four to give the correct aggregate width (0.5 in.). Specimens and apparatus were in thermal equilibrium with the testing atmosphere at each test temperature. The data are summarized in Table X and are shown graphically in Fig. 20.

Impact strength was also determined by a falling-ball method. Specimens 6 in. square and of several thicknesses were bolted into a heavy steel frame (Fig. 21), and a 2 lb. steel ball was allowed to fall onto the center of the panel from a predetermined height. The limiting height which would just cause fracture of the specimen was determined by repeated trials. Samples were preconditioned at 50° C., as

19



***19**—These curves show graphically the effect of temperature on shear strength of cellulose acetate and cellulose nitrate sheet plastics. **20**—This chart presents curves showing the effect of test temperatures on impact strength of cellulose acetate and of cellulose nitrate sheet plastics*

20

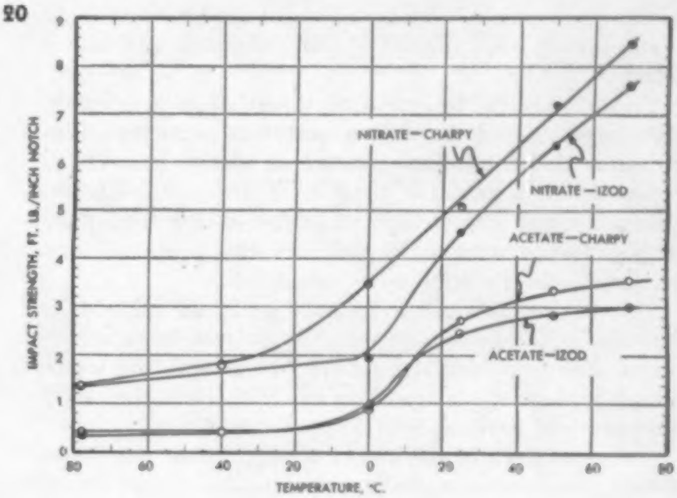


Table X.—Effect of Temperature on Impact Strength of Cellulose Sheet Plastics[a]

Temperature		Charpy impact strength	Izod impact strength
° C.	° F.	ft.-lb./in. of notch	ft.-lb./in. of notch
Cellulose acetate			
−78	−108	0.41 ± 0.01	0.34 ± 0.02
−40	−40	0.45 ± 0.01	0.40 ± 0.02
0	32	0.91 ± 0.03	0.96 ± 0.03
25	77	2.73 ± 0.03	2.45 ± 0.04
50	122	3.34 ± 0.02	2.85 ± 0.03
70	158	3.56 ± 0.03	3.02 ± 0.04
Cellulose nitrate plastic			
−78	−108	1.39 ± 0.03	1.38 ± 0.02
−40	−40	1.83 ± 0.02	1.77 ± 0.03
0	32	3.48 ± 0.01	1.96 ± 0.04
25	77	5.13 ± 0.02	4.55 ± 0.02
50	122	7.20 ± 0.04	6.36 ± 0.04
70	158	8.48 ± 0.03	7.61 ± 0.04

[a] Specimens preconditioned 48 hr. at 50° C. (122° F.) and stored in a desiccator. Specimens were made up of four 0.125-in.-thick notched pieces bound together and were broken edgewise.

Table XI.—Effect of Temperature and Thickness on Falling-Ball Impact Strength of Cellulose Sheet Plastics[a]

Temperature		Height of drop of 2-lb. ball to break					
		Cellulose acetate			Cellulose nitrate		
		0.030 in.	0.060 in.	0.125 in.	0.030 in.	0.060 in.	0.125 in.
° C.	° F.	ft.	ft.	ft.	ft.	ft.	ft.
−65	−85	1	1 1/2	2	7	9	14
−40	−40	4 1/4	6	7	8	14	23
−10	14	6 1/4	13	32 1/2	10	19	49
25	77	7 1/4	17 1/2	>60	14	23	>60
50	122	9 1/2	19 1/2	>60	17	28	>60
70	158	12	24	>60	20	35	>60

[a] Specimens 6 × 6 in. were preconditioned 48 hr. at 50° C. (122° F.) and stored in a desiccator.

described above, and both samples and steel frame were conditioned to thermal equilibrium at the desired temperature before testing. The results are summarized in Table XI and shown graphically in Fig. 22.

Discussion of results

The general effects of temperature, humidity and testing speed have been pointed out previously by Carswell and Nason.[1] The data herein presented are in line with these conclusions. Cellulose acetate and cellulose nitrate sheets are typical thermoplastics. Acetate is fairly sensitive to changes in moisture content, nitrate only moderately so. Acetate is also slightly more affected by temperature changes than is nitrate.

Tensile strength, flexural strength, compressive strength, shear strength and the various moduli of elasticity all increase as the ambient temperature or relative humidity is reduced and decrease as these conditions are increased. Elongation and impact strength, however, decrease as the ambient temperature or relative humidity is lowered and increase as these conditions are raised.

Tensile strength tends to increase as the testing speed is increased. Elongation and reduction in area, however, decrease with increasing test speed. In general, the tensile strength of these plastics decreases with increasing sheet thickness and increases with decreasing thickness.

The data given in this report are for typical production materials and are known to be representative. Since they are based on a limited number of tests and on only a few samples of materials, they should not be regarded as minimum values for design or specification purposes. A much larger number of tests should be made and evaluated statistically before any such values are set up.

Acknowledgment

We are indebted to Mr. R. H. Hunt, Jr., for some of the data on tensile properties of cellulose nitrate; to Mr. J. H. Watt and Dr. David Telfair for some of the compressive data; to Miss Dorothy L. Woodruff for assistance with much of the test work and Mr. M. L. Jewell for photographs.

References

1 "Effect of Environmental Conditions on the Mechanical Properties of Organic Plastics," by T. S. Carswell and H. K. Nason. Paper presented at the A.S.T.M. Symposium on Plastics, Philadelphia, Pa., Feb. 22, 1944; Modern Plastics *21*, 121–26, 158, 160 (June 1944), 125–30, 160, 162 (July 1944).

2 "Mechanical Tests of Cellulose Acetate," by W. N. Findley, Proc. A.S.T.M. *41*, 1231–45 (1941); Modern Plastics *19*, 57–62, 78 (Sept. 1941).

3 "Mechanical Tests of Cellulose Acetate. Part II on Creep," by W. N. Findley, Proc. A.S.T.M. *42*, 914–22 (1942); Modern Plastics *19*, 71–3, 114(Aug. 1942).

4 "Mechanical Tests of Cellulose Acetate," by W. N. Findley, Trans. A.S.M.E. *65*, 479–87 (1943); Modern Plastics *20*, 99–105, 138 (Mar. 1943).

5 "1943 Plastics Catalog," Plastics Catalogue Corp., New York 290–91.

6 "Handbook of Plastics," by H. R. Simonds, C. Ellis and M. H. Bigelow, D. Van Nostrand Co., New York 510–13 (1943).

7 British Standards Institution Specification F-56, "Transparent Sheets for Observation Panels," London (Mar. 1934).

8 Air Corps Specification No. 12025-B, "Plastic, Sheet, Cellulose Acetate Base," Materiel Div., U.S.A.A.F., Wright Field, Dayton, Ohio (issued Nov. 19, 1940, amended Sept. 27, 1943).

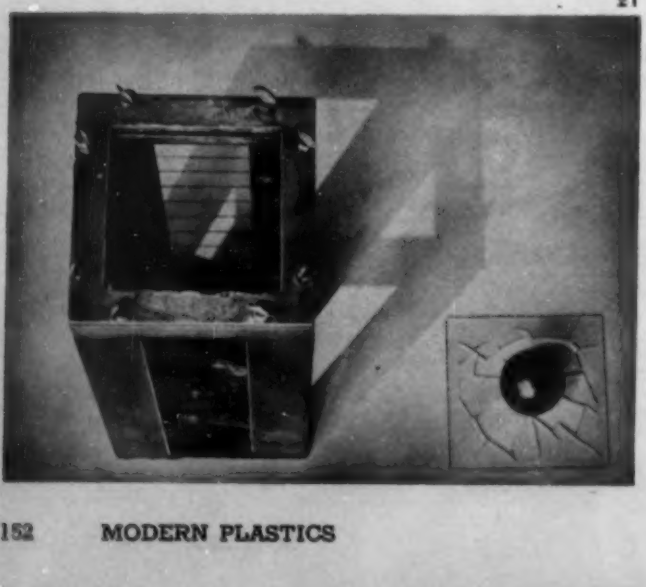
9 Navy Aeronautical Specification P-41c, "Plastic, Transparent, Flame-Resisting Sheet" (Feb. 22, 1943).

10 "Tentative Specification for Cellulose Acetate Plastic Sheets," A.S.T.M. Designation D 786–44 T.

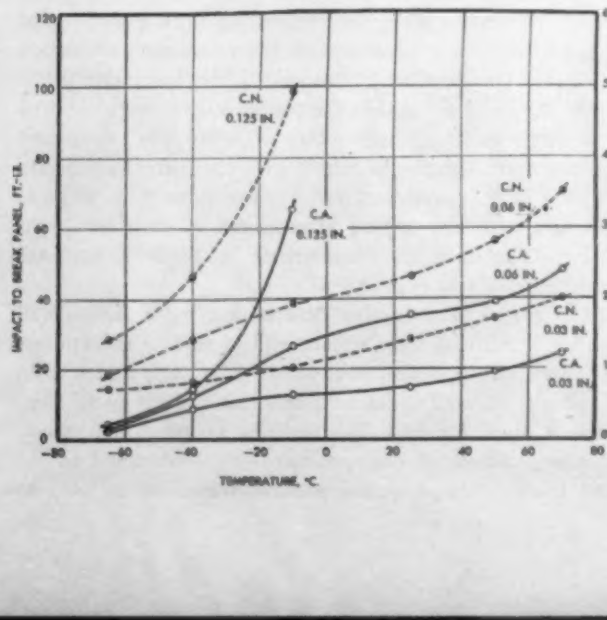
(Please turn to page 188)

21—This apparatus is used for falling-ball impact test. 22—This chart shows effect of temperature on falling-ball impact strength of cellulose acetate and cellulose nitrate sheet plastics

21



22



Calculating time-temperature schedules for curing resin adhesives

by THOMAS D. PERRY*

THE proper cure of a resin adhesive depends on two principal factors—the net time required for an adequate cure of the adhesive under consideration and the time needed for the heat to penetrate through the layers from the source of heat to the glue joint farthest removed from the source of heat. Many synthetic resin manufacturers provide combination time-temperature schedules for standard plywood constructions and for some laminated constructions. Such schedules are usually based upon thickness and the external temperature applied.

There is, however, a wide range of special constructions for which no standard schedules have been developed and for which individual determinations need to be made. It is important to predetermine, so far as practicable, an approximate bonding requirement in order to ascertain such facts as plant capacity and production costs on any new item on which shop experience is not available. For such cases a method has been developed to calculate the required bonding cycles. This method is not absolute, but is subject to verification under operating conditions.

To calculate a special schedule of required clamping cycles for any special resin-bonded construction, two basic graphs or tables are necessary. From these two sources when used in combination with two simple formulas the required bonding time can be ascertained. The derivation of these data is fully outlined below. The calculations have been carried through for Amberlite PR-14, but the same procedure could be developed for any adhesive resin, substituting the proper data in the two tables or graphs and utilizing the same formulas.

Absolute rate of cure

The graph and table presented in Fig. 1 are typical for the rate of cure of Amberlite PR-14. Corresponding tables and graphs for any other resin adhesive should be secured from the supplier. The derivation of these graphs and tables is found by determining the actual time required to cure the resin at a given temperature and the rate of reaction change above and below that point. The result is a straight-line relation on semilogarithmic paper which can be converted into the graph and table given in Fig. 1. A more complete description of the derivation of these charts has been published by Grinsfelder and Collins.[1]

Rate of heat penetration

A typical graph of this heat-penetration determination is given in Fig. 2 where thermocouple readings, indicating the actual temperature at the glue line that is most remote from the source of heat, are plotted with regard to time and attained temperature. This has been done on the graph for 3/8, 5/8, 13/16, and 1 in. thick flat plywood. However, the computations that follow are based on the 1 in. construction, indicated by the lower curve on the graph. The temperature of the steam platen or source of heat was maintained at 300° F. throughout the test. At 40 min. of elapsed time the thermocouple indicates a temperature of 268° F. at the most remote glue line on the 1 in. thick construction. The step-wise method of calculation, indicated by the shaded angles on Fig. 2, was originated by A. R. Bryant.[2]

If either cauls or rubber bags are employed in making the special construction under test, they should be similarly included in the assembly for heat determination. These thermocouple (or pyrometer) readings should be recorded and

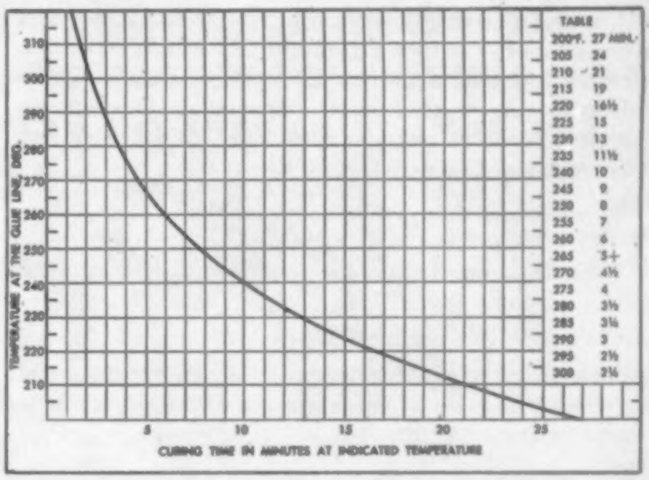
* Development engineer, Resinous Products & Chemical Co.

[1] Henry Grinsfelder and Maxwell R. Collins, "Plywood Bonding," Industrial & Engineering Chemistry 36, 152–7 (Feb. 1944).

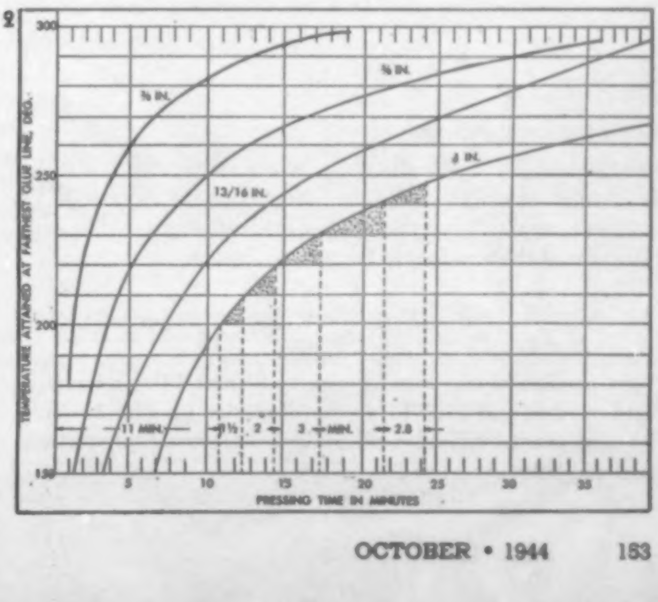
[2] A. R. Bryant, "The Bonding of Tego Glue Film in Plywood," Forest Products Research Laboratory, Department of Scientific and Industrial Research (1941).

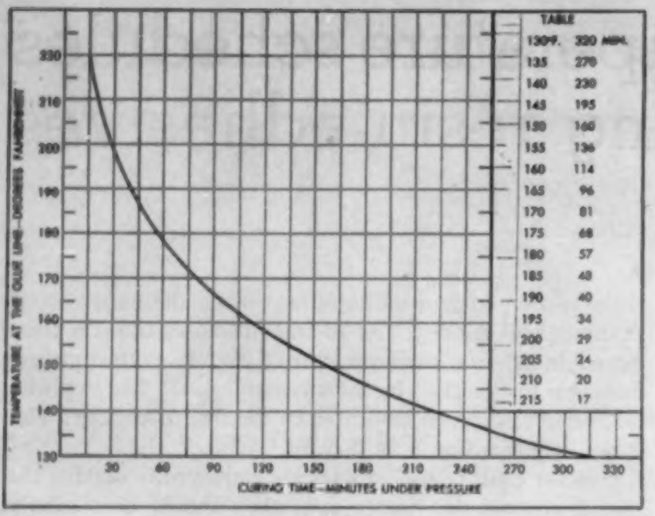
1—This graph and table are typical for the rate of cure of Amberlite PR-14. 2—A typical graph of heat-penetration determination where the thermocouple readings, indicating the actual temperature at the glue line that is most remote from the source of heat, are plotted with regard to the time and to the attained temperature

1



2





3—*Graph and table similar to Fig. 1 for the rate of cure of a moderate temperature phenolic resin adhesive*

plotted for each elapsed minute from the start of the heat application, and they should be continued long enough to run beyond the anticipated special schedule requirements.

Determination of formulas

It is assumed that no appreciable cure of the resin adhesive under investigation occurred below 200° F.—a figure which is on the conservative side. It can be noted on the graph in Fig. 2 that a certain number of minutes is required for the temperature to rise from 200 to 210° F. It is another conservative assumption that this temperature range represents a fraction or percentage of the total time required for complete cure, which may be averaged at 205° F. The following symbols are adopted for each temperature range:

T_E = Elapsed time in minutes for each 10° F. temperature range.
T_C = Total time in minutes required to cure at any given temperature.
P = Percentage of total cure.

By the use of these symbols the following formulas are set up which will apply in any temperature range if the proper values for that range are used.

$$\frac{T_E}{T_C} \times 100 = P \qquad (1)$$

$$T_E = \frac{P \times T_C}{100} \qquad (2)$$

Computation procedure

The value for T_E for the temperature range 200 to 210° F. is 1.5 min., as read from Fig. 2. The value for T_C at 205° F. is 24 min. as read from the table or graph of Fig. 1. The substitution of these values in formula (1) gives:

$$\frac{T_E}{T_C} \times 100 = P = \frac{1.5}{24} \times 100 = 6.3 \text{ percent} \qquad (1A)$$

This portion of the cure, between 10 and 11½ min., and between 200 and 210° F., is shown shaded on Fig. 2. Subsequent shaded triangles are indicated for the computations outlined below.

Similarly, substitution of the proper values for the temperature range 210 to 220° F. and the mid-temperature point 215° F. gives:

$$\frac{T_E}{T_C} \times 100 = P = \frac{2}{19} \times 100 = 10.5 \text{ percent} \qquad (1B)$$

Again substituting for range 220 to 230° F. and 225° F. gives:

$$\frac{T_E}{T_C} \times 100 = P = \frac{3}{15} \times 100 = 20.0 \text{ percent} \qquad (1C)$$

Again substituting for range 230 to 240° F. and 235° F. gives:

$$\frac{T_E}{T_C} \times 100 = P = \frac{4}{11.5} \times 100 = 34.8 \text{ percent} \qquad (1D)$$

Summarizing, the following total is obtained:

200 to 210° F., Formula (1A)	6.3 percent
210 to 220° F., Formula (1B)	10.5 percent
220 to 230° F., Formula (1C)	20.0 percent
230 to 240° F., Formula (1D)	34.8 percent
	71.6 percent
Still required for complete cure at 240° F.:	28.4 percent
	100.0 percent

The time required for this completion of cure, 28.4 percent is found by the use of formula (2) and substituting the proper value of T_C at 240° F. from the graph on Fig. 1, viz.:

$$T_E = \frac{P \times T_C}{100} = \frac{28.4 \times 10}{100} = 2.8 \text{ min.} \qquad (2A)$$

This gives following total time required for a complete cure:

Minutes to reach 200° F. (no cure assumed)	11.0 min.	
Interval at 200 to 210° F.	1.5 min.	(1A)
Interval at 210 to 220° F.	2.0 min.	(1B)
Interval at 220 to 230° F.	3.0 min.	(1C)
Interval at 230 to 240° F.	4.0 min.	(1D)
Remainder of cure at 240° F.	2.8 min.	(2A)
Total time of cure	24.3 min.	

This total—approximately 25 min.—should be allowed for the cure of Amberlite PR-14 in this type of construction, 1 in. thick, where the heat is 300° F.

A similar determination can be made by this method and these formulas for any other resin and special construction. An additional chart of this type for Amberlite PR-75-B, a moderate-temperature phenolic resin adhesive, is given in Fig. 3. When accompanied by a counterpart of the chart shown in Fig. 2, developed by the prospective user but based on PR-75-B, the same method of calculation could be employed for ascertaining the proper time-temperature requirements. With these two graphs available, the appropriate substitutions can be made in the formulas as outlined.

This method of determining bonding schedules can be carried out on a laboratory or plant scale. It needs only a suitable type of pyrometer. In laboratory work the thickness of the assembly can be actual; nominal lengths and widths of 10 to 20 in. should give satisfactory results. After completing the calculated base, production runs can be used to verify results.

When the manufacturing facilities in the plywood and laminating industries are relieved of their urgent war work it can be confidently predicted that such manufacturing plants will develop many new products and processes which will find applications in our domestic economy. At such time the value of this method of predetermining proper bonding schedules for resin adhesives will become increasingly important.

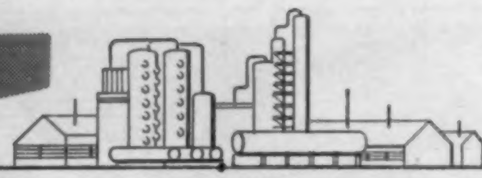
KOPPERS COMPANY

serves

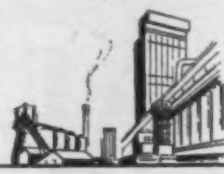
The Chemical Industry

COAL . . . Koppers is one of the largest producers of bituminous coal—fundamental to most industries, but particularly to the chemical industry

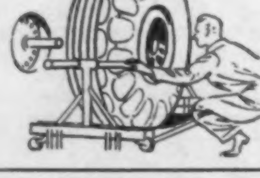
CHEMICALS . . . Koppers produces tar acids—phenol, cresols, and xylenols; tar bases—pyridine, picolines, lutidines, quinoline, and wide or narrow boiling fractions of tar bases; naphthalene, benzene, toluene, xylenes, solvent naphtha, indene, pitch coke, and other products for the chemical industry



CHEMICAL PLANTS . . . Koppers manufactures creosote for timber preservation, pitch for roofing and waterproofing, protective coatings, paints and mastic floor compounds used in the construction of chemical plants. Its Wood Preserving Division applies preservative, fireproofing, and waterproofing treatments to timber



COKE OVENS . . . Koppers builds and operates coke ovens and coal carbonization product recovery and refining equipment



SYNTHETIC RUBBER . . . Koppers United Company built and is operating one of the country's largest plants for the production of butadiene and styrene used in making synthetic rubber.

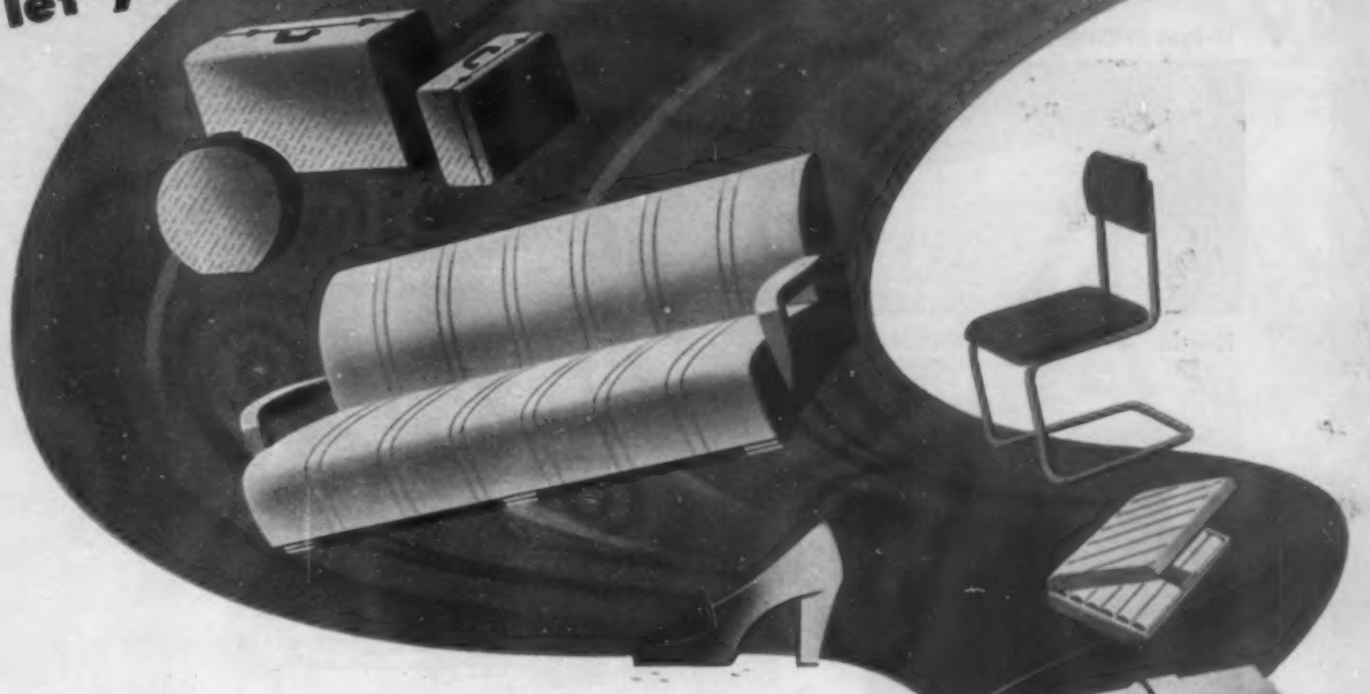
Your inquiries are invited for Koppers products or services

KOPPERS

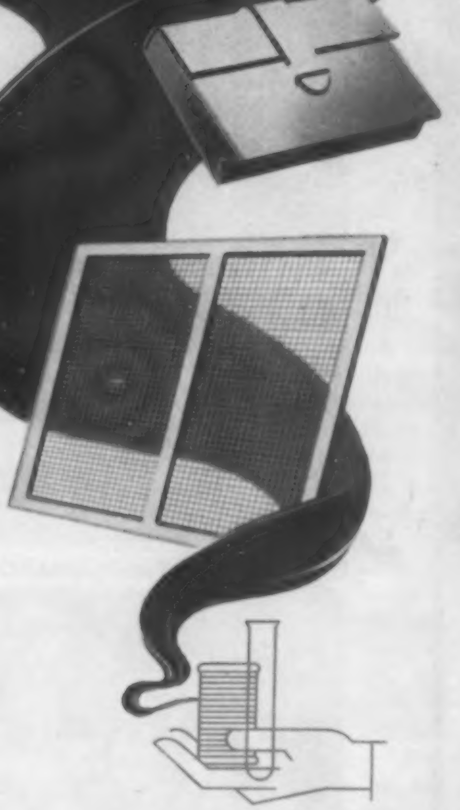
the Industry that serves All Industry

KOPPERS COMPANY, PITTSBURGH 19, PA.

let yourself go on COLOR!



any effect is practical with VELON*



Any effect—anywhere! Now you can use light, bright shades, delicate tints, in places you never dared consider them before.

You can use them in the upholstery of train, plane and bus seats, on the dustiest, smokiest runs . . . for seating in waiting rooms and lobbies, on ocean liners and pleasure craft subjected to salt air and spray . . . for window screening in any climate.

For all these you can use the same brilliant tones, the same gay patterns as in women's handbags, shoes, belts and hats. Because they, too, can be equally, and beautifully, made of *Velon.*

In any form, *Velon* can take any abuse and come up smiling after a mere wipe with a damp cloth or cleaning fluid.

Velon won't absorb moisture, won't let dirt cling, gives grease no foothold. It resists alkalis, acids, solvents. It is stainless, non-fading, non-inflammable.

Let yourself go on color. *Velon* will make it practical.

For full information, write to Firestone Industrial Products Co., Akron, Ohio or Fall River, Mass.

FOR THE BEST IN MUSIC, LISTEN TO THE VOICE OF FIRESTONE MONDAY EVENINGS OVER THE ENTIRE NBC NETWORK.

ANOTHER CONTRIBUTION TO A BETTER WAY OF LIFE by **Firestone**

*Trademark—Pronounced VEL-LÓN

TECHNICAL BRIEFS

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

Engineering

FORMING PROPERTIES OF VULCANIZED FIBRE SHEET. C. A. Hedges. Automotive and Aviation Ind. *90*, 40, 64 (Apr. 1, 1944). Tests were made to determine the moldability of vulcanized fibre sheet. The results are as follows: 1) Fibre must be water- or steam-soaked from 5 to 15 min. before forming, depending on the severity of the operation and the gage of the material. 2) Parts must be held in shape until dry. 3) Parts must be coated after drying to prevent subsequent warpage due to moisture absorption. 4) Tooling should be such as to hold parts in shape until dry; heated tools accelerate this process. Wood drying blocks also may be used. 5) Draw dies must have positive-pressure pad-draw ring clearance, and punch and draw radius equal to a minimum of 12 times the thickness. 6) Fibre may be bent to a radius equal to the thickness after soaking. 7) Cups may be drawn to a depth equal to the cup radius after soaking. 8) Corner radii should be held to a minimum of 1 inch. 9) Fibre will stretch, but has very little tendency to shrink. 10) Except for bending operations, fibre should not be formed in gages thicker than 0.081 inches.

AIR-EXPANDED PLASTIC RIVETS. Iron Age *154*, 52–3 (July 27, 1944). Heated hollow rivets made of plastic are driven into the rivet holes and then expanded with compressed air. They are recommended for attaching fabric to metal, wood to plastic, metal to plastic, rubber to plastic, etc. Various methylmethacrylate, ethyl-cellulose and cellulose-acetate-butyrate compositions were investigated for this application; the methylmethacrylate resins are the most suitable. Advantages are low cost, ease of installation and satisfactory strength.

SOME INTERESTING WOVEN PLASTIC DEFECTS. Rayon Textile Monthly *25*, 134–5 (Mar. 1944). Twelve defects often encountered in weaving synthetic resin yarns are illustrated. The cause of and cure for each defect are given in this article.

PLYWOODS FOR PRESENT AND POSTWAR PRODUCTS. Product Eng. *15*, 541–57 (Aug. 1944). Types of veneers, methods of cutting veneers, properties of various woods, characteristics of plywood adhesives, methods of joining and forming plywood parts, methods for manufacturing plywood, properties of plywoods and various products made of plywood are discussed.

INTERPRETATION OF MECHANICAL DATA NECESSARY IN PLASTIC PART DESIGN. W. S. Larson. Product Eng. *15*, 469–72 (July 1944). The properties of plastics are discussed from the viewpoint of design and application. Test results are obtained at arbitrary conditions, and large allowances must be made for actual service conditions. Actual test results may usually be duplicated within 10 percent. Common causes of mechanical failure are high temperatures and shock loads. Parts may be strengthened by careful design giving particular attention to wall thicknesses, radii and fillets. A wide range of properties are available in the various plastic formulations but improvement in hardness and tensile strength generally results in a decrease in impact strength and also in elongation.

Chemistry

THE REACTION VELOCITY OF ION EXCHANGE. F. C. Nachod and W. Wood. J. A. C. S. *66*, 1380–4 (Aug. 1944). The reaction rates of various cation and anion exchangers were measured at various temperatures. It was found that the reactions were second-order bimolecular reactions and that the values could be calculated by using concentrations instead of activities. The rate of anion exchange or acid absorption is very much slower than the rate of the cation exchange reactions — suggesting a different reaction mechanism for this class of exchangers. Various commercial ion exchangers display differing reaction rates under the same experimental conditions. These rate data permit prediction of operating characteristics and required contact periods for different temperatures and exchange unit designs.

POLYMERIZATION OF VINYL DERIVATIVES IN SUSPENSION. I. W. P. Hohenstein, F. Vingiello and H. Mark. India Rubber World *110*, 291–94, 300 (June 1944). Each monomer has specific reaction conditions for polymerization in suspension. The polymerization itself seems to proceed like an effectively-cooled, speeded-up bulk polymerization. The resulting high polymers appear in the form of regularly-formed spheres of controlled and fairly uniform size. They may be translucent or opaque, hard, soft, or rubbery, soluble or only swellable according to the monomer or combinations of monomers. The average molecular weights of polystyrene "pearls" under prevailing reaction conditions are in the neighborhood of 100,000.

DIVISION OF HIGH-POLYMER PHYSICS HOLDS INAUGURAL MEETING. Rubber Age *55*, 371–5 (July 1944). Abstracts of the papers presented at the inaugural meeting of the Division of High-Polymer Physics of the American Physical Society in Rochester during June are given. The titles and authors are as follows: Theory of Filler Reinforcement, by E. Guth and H. M. James; Rise of Temperature on Fast Stretching of Butyl Rubber, by S. L. Dart and E. Guth; Retraction of Stressed Rubber, by B. A. Mrowoa, S. L. Dart and E. Guth; Molecular Weight Studies of Some High Polymers, by P. M. Doty, B. H. Zimm and H. Mark; Factors Influencing the Brittle Point of High Polymers, by R. S. Spencer and R. F. Boyer; Relations Between Stress, Strain and Temperature in a Pure-Gum Vulcanizate of GR-S, by F. L. Roth and L. A. Wood; A Molecular Theory of the Viscoelastic Behavior of an Amorphous Linear Polymer, by T. Alfrey; Electrostatic Properties of Rubber and GR-S, by R. S. Havenhill, H. C. O'Brien and J. J. Rankin; Speed of Retraction of Rubber, by R. B. Stambaugh, M. Rohner and S. D. Gehman; Some Physical Properties of Elastomers at Low Temperatures, by H. E. Greene, C. W. Harris and D. L. Loughborough; Limiting Law of the Reinforcement of Rubber, by H. M. Smallwood; Some Low Temperature Properties of Elastomers, by F. S. Conant and J. W. Liska; The Thermodynamics of Rubber at Low Extensions, by D. R. Elliott and S. A. Lippmann; Transition Phenomena in High Polymers, by W. O. Baker; Systems with Superposed Viscous and Elastic Behavior, by A. V. Tobolsky; Kinematic Errors in Bobbin Drives on Roving Frames, by S. L. Gerhard; Control of Elongation in Highly Stretched Cotton Tire Cord, by H. J. Philipp and C. M. Conrad; The Influence of Velocity Gradient on the Relation Between Viscosity and Concentration in Cuprammonium Solutions of Cellulose, by W. J. Lyons; Electrical Anisotropy of Xerogels of Hydrophile Colloids, by S. E. Sheppard and P. T. Newsome; Determination of Molecular Weight Distribution in High Polymers by Solubility Methods, by D. R. Morey and J. W. Tamblyn; Fractionation, Vis-

cosity and Osmotic Pressure Studies on Cellulose Esters, by J. W. Tamblyn, R. L. Tichenor, D. R. Morey and R. H. Wagner; Comparison of the Structures of Stretched Linear Polymers, by M. L. Huggins.

MOLECULAR WEIGHT DISTRIBUTION IN HIGH POLYMERS. Trans. Faraday Soc. *40*, 217–279 (June 1944). This issue contains eight articles and is devoted exclusively to a symposium on molecular weight and molecular weight distribution in high polymers. H. W. Melville in a General Introduction (pages 217–220) discusses briefly the following methods for measuring molecular size and distribution of high polymers: 1) end group methods, 2) osmotic methods, 3) ultracentrifuge methods, 4) viscosity methods, and 5) fractionation methods. The titles and authors of the remaining papers in this British symposium are as follows: Molecular Weight and Shape of Macromolecules in Solution, by H. Campbell and P. Johnson (pp. 221–233); Osmotic Pressure of High Polymer Solutions and Molecular Weight, by E. A. W. Hoff (pp. 233–236); Study of the Mechanism of Polymerization Reactions by Means of Size-Distribution Curves, by E. F. G. Herington (pp. 236–240); Kinetics of Polymerization Reactions, by G. Gee and W. H. Melville (pp. 240-251); Melting of Crystalline Polymers, by E. M. Frith and R. F. Tuckett (pp. 251–260); Interpretation of Molecular Weight Measurements on High Polymers, by G. Gee (pp. 261–266); Degradation of Long Chain Molecules, by H. H. G. Jellinek (pp. 266–273); Discussion (pp. 273–279).

Properties

FLOW PROPERTIES OF POLYVINYL-CHLORIDE PASTES. H. Saechtling. Kunststoffe *33*, 127–31 (1943); Chem. Abstracts *38*, 3045 (June 20, 1944). The viscosities of pastes made by mixing polyvinyl chloride with plasticizers at low temperatures were measured. The resin content ranged from 50 to 70 percent. Aging exerts a greater effect on the viscosity than repeated homogenization does. Thixotropic and viscosity anomalies are small. The viscosity anomalies disappear on aging. The yield values increase with increasing resin content. The viscosities of aged pastes range from 75 to 4000 poises; the values depend on the resin content and the plasticizer. Replacement of part of the polymer with inert filler decreases the viscosity.

LIGHTWEIGHT PLYWOOD TUBING IS STRONG STRUCTURAL MATERIAL. Product Eng. *15*, 489–91 (July 1944). Method of fabrication, properties and applications of resin-bonded plywood tubing are described. The average strength characteristics are as follows: ultimate compressive strength, 11,500 p.s.i.; compressive proportionality limit, 6000 p.s.i.; ultimate tensile strength, 11,500 p.s.i.; tensile proportionality limit, 6000 p.s.i.; Young's modulus, 1,500,000 p.s.i.; buckling failure (Euler's formula), 11,000 p.s.i.

SURFACE HARDNESS OF PLASTICS. H. Perkuhn. Luftfahrt-Forsch. *20*, 297–9 (1943); Chem. Abstracts *38*, 2764 (June 10, 1944). Scratch-hardness tests and Vickers-hardness tests were made on three methacrylate resins, polyvinyl chloride, and a cellulose acetate plastic. Between 4 and 45° C. scratch-hardness tests are more reproducible and give constant ratios with tensile strengths. The ratio of tensile strength in kg./cm.^{2} to scratch hardness in kg./cm.^{2} was 0.087 for the methacrylate resins, 0.113 for the vinyl resin and 0.157 for the cellulose acetate plastic. The largest variations were ±2.5 percent. The scratch hardness values were determined with a 10-gr. load and the tensile strength at 0.3 mm./sec.

PERFORMANCE OF WOOD-FLOUR-FILLED PHENOLIC PLASTICS AT HIGH HUMIDITIES. J. Busch. Kunststoffe *33*, 265–7 (1943); Chem. Abstracts *38*, 3043 (June 20, 1944). The moisture absorption, dimensional stability and changes in flexural and impact strengths of 20 woodflour-filled phenolic plastics were determined after storage at 42° C. (108° F.) and 90 to 95 percent relative humidity for 4 months. Some of the compositions contained ammonia, others did not. The resin content varied from 40 to 55 percent. The highest moisture absorption observed was 6.5 percent; the greatest increase in length was 4.8 percent in the direction of molding pressure and 3.0 percent at right angles to the direction of molding pressure. The maximum reduction in flexural strength was about 40 percent and the maximum reduction in impact strength was about 30 percent. No definite relationship was noted between the changes observed and the composition of the plastic and the molding pressure. There is a definite decrease in strength with increase in moisture absorption. If maximum mechanical properties at high humidities are desired, materials with the lowest moisture absorption values should be selected.

ELECTRICAL RESISTANCE OF PLASTICS. R. Vieweg and F. Gottwald. Kunststoffe *33*, 289–90 (1943); Chem. Abstracts *38*, 3044 (June 20, 1944). The effect of oil films on the electrical resistance of polystyrene, methyl methacrylate resin and polyvinyl chloride at different relative humidities was determined by an electrometer-discharge method. The surface resistivity decreases as the relative humidity increases. The electrical resistance of polyvinyl chloride is affected the most by changes in moisture followed by methyl methacrylate resin and polystyrene. Oil films reduce the effects of exposure to high humidities of polystyrene and methacrylate resin. The electrical resistance of polyvinyl chloride at high humidities is decreased by coating with films of paraffin oil and lubricating oil.

Testing

TEST METHODS FOR LEATHER SUBSTITUTES. H. Herfeld, R. Schubert and R. Schöpel. Kunststoffe *33*, 228–31 (1943); Chem. Abstracts *38*, 3046 (June 20, 1944). Test methods for determining tensile strength and elongation, tear resistance, stiffness, flex-fatigue resistance, torsion strength, resistance to cracking at low temperature, thermal conductivity, resistance to perspiration, and bond strength of plastic-coated materials used as leather substitutes are discussed in this article.

Synthetic rubber

NATURAL AND ACCELERATED LIGHT AGING OF HEVEA AND GR-S VULCANIZATES. R. E. Morris, J. W. Hollister, A. E. Barrett, and T. A. Werkenthin. Rubber Age *55*, 45–52 (Apr. 1944). The carbon-arc accelerated light aging method does not correlate with sunlight, regardless of the carbons or filter arrangements used, in its action on pure-gum Hevea stocks and loaded GR-S stocks. By improving the cooling arrangement, correlation was obtained for Hevea stocks but not for the GR-S stocks.

CELLULAR RUBBERS. L. P. Gould. Rubber Age *54*, 526–30 (Mar. 1944); *55*, 65–7 (Apr. 1944). Cellular rubbers are divided into the following classes: multicellular (open-cell structure), uni-cellular (closed-cell structure), micro-cellular and related products. The related products include impregnated fibers, expanded plastics, cellulose sponges and foams made from glass. Multi-cellular rubbers are made 1) by mixing a gas-producing chemical such as sodium bicarbonate with slab rubbers and then vulcanizing, 2) by saturating uncured stock with a gas and then releasing the pressure slowly as the mass is cured, 3) by whipping gases into the lattices, and 4) by mixing a low boiling point liquid with latex emulsions and curing the composition. Unicellular rubbers are made 1) by dissolving a gas such as nitrogen at high pressure (4500 lb./in^2) in the rubber and then allowing it to expand in a slow-curing process, and 2) by mixing a gas-producing chemical with slab rubber, curing partially, allowing to expand and then completing the cure in a closed mold. Micro-cellular rubbers are made 1) by curing wet coagulations under con-

ditions which will trap the water in the product during vulcanization, and 2) by expanding the trapped air bubbles obtained when latex is dried on a blanket. Cellular thermoplastics are being made by mixing them with a blowing agent and extruding them from a hot die. Cellulose sponges are made by mixing sodium sulfate crystals with viscose, coagulating the viscose and then leaching out the sodium sulfate with warm water. To control the processes the following principles must be considered: 1) The uncured mass must be plastic. 2) The rate of blow and the rate of cure must be balanced. 3) The internal pressure must exceed the external pressure. 4) The rate of heat transfer must be controlled (troubles generally result from too low rates). The present status of the cellular-rubber industry and the manufacture of cellular rubbers from the new synthetic rubbers are discussed.

OBSERVATIONS ON THE X-RAY STRUCTURE OF RUBBER AND THE SIZE AND SHAPE OF RUBBER CRYSTALLITES. S. D. Gehman and J. E. Field. J. Applied Phys. *15,* 371–9 (Apr. 1944). Vulcanized rubber is composed of a cross-linked network of chain molecules, segments of which are sufficiently free and mobile in localized regions to form a crystal lattice upon stretching. The crystallites thus formed represent an automatic molecular mechanism for re-enforcement and are analogous to particles of re-enforcing pigment which increase the modulus, strength and tear resistance. These effects depend upon the number of particles present and their size and shape. X-ray determinations were made of the crystallite sizes in a series of vulcanized gum stocks using the Scherrer method but calculating the diffraction broadening by the formula proposed by Taylor. Evidence was found that the crystallite size distribution was heterogeneous and included small crystallites which broadened the base of the diffraction peaks. It could be shown that a high degree of crystallinity in a compound was associated with small crystallite size. Both of these factors combine to give high-modulus stocks. For different cures with a given rubber-compounding formula, there is a definite correlation between the amount of combined sulfur and the crystallite size. This indicates that irregularities in the structure caused by the combined sulfur tend to limit the crystallite growth. This interpretation is preferred although the experimental evidence is not decisive as to whether or not lattice distortion contributes to the width of the diffraction spots. Significant conclusions can be drawn from the work in regard to crystallite formation in stretched rubber and effects of crystallites on the physical properties.

THEORY OF THE ELASTICITY OF RUBBER. H. M. James and E. Guth. J. Applied Phys. *15,* 294–303 (Apr. 1944). Natural rubber is the prototype of an important class of materials consisting of long flexible molecules which interact with each other in a particular way. Some of the properties of bulk rubber are strikingly similar to, and may be understood by a consideration of, those of single flexible molecules. For a complete understanding of the behavior of rubberlike materials it is necessary to understand the way in which they are built up from the component flexible molecules. In vulcanized materials, in which plasticity is suppressed, intermolecular bonds link the molecules into a coherent network, very irregular in detail but isotropic and homogeneous on the average. In lightly vulcanized materials these bonds are relatively few and bring relatively small portions of adjacent molecules into fixed relations to each other. For the most part the interaction of neighboring molecules in the material is that characteristic of liquids. It is the presence of the intermolecular bonds, which link the molecules into a network and thus control its form, which differentiates rubberlike materials from liquids. It is the small number of these bonds, and their weak control of the form of material through the entropy rather than the internal energy, which differentiates rubberlike materials from ordinary solids. On the basis of this picture of the structure of rubber there is derived a form for the stress-strain curves at moderate extension which is in good agreement with experiment.

HYSTERETIC AND ELASTIC PROPERTIES OF RUBBERLIKE MATERIALS UNDER DYNAMIC SHEAR STRESSES. J. H. Dillon, I. B. Prettyman and G. L. Hall. J. Applied Phys. *15,* 309–23 (Apr. 1944). The nature of hysteresis in products such as pneumatic tires, solid tires and transmission belts is analyzed, and the requirements of a laboratory test for evaluating the relative hysteretic characteristics of natural and synthetic rubber stocks are developed. The signifiance of various definitions of the "hysteresis defect" in rubberlike materials is discussed. A forced resonance vibrator in which rubber samples are deformed in shear at frequencies of 20 to 300 cycles per second, shear strains of 0.05 to 0.35, and temperatures of –20 to +120° C. is described. Experimental results obtained with natural rubber and GR-S gum and tread stocks are presented. The hysteresis index is found to be nearly independent of dynamic shear strain while the dynamic modulus decreases moderately with increasing dynamic strain. Neither hysteresis index nor dynamic modulus depends upon the height to diameter ratio of cylindrical samples. These results are at variance with those obtained by previous investigators who, employing compressive vibrations, have reported marked dependences of both modulus and friction upon dynamic strain and the "shape factor" of tread-type stocks. In agreement with previously reported work, the dynamic modulus is found to be independent of frequency and the hysteresis index only slightly dependent upon frequency, for tread-type stocks. Results are presented for stocks based on Buna S type copolymers with varying monomer ratios and on N-type Butaprenes, Neoprene, and butyl rubbers. Nineteen references are given.

RHEOLOGICAL PROPERTIES OF NATURAL AND SYNTHETIC RUBBERS. R. H. Kelsey and J. H. Dillon. J. Applied Phys. *15,* 352–9 (Apr. 1944). An extrusion plastometer for rubberlike materials which measures the shearing stress at a predetermined constant average rate of shear and a given temperature is described. In one filling of the extrusion chamber, requiring about 10 cm^3 of sample, the average rate of shear is set at three or four different values in the range of 5–100 $sec.^{-1}$ and corresponding average shearing stresses are read by means of a pressure gauge. A plot of these data gives a complete rheological curve from a single determination. Typical curves are given for Hevea smoked sheets, GR-S and Butaprene NM for GR-S masterbatches and normal tread stocks. The effect of capillary geometry is estimated. The effects of milling and of temperature upon the rheological properties of several rubbers are discussed. Typical data for GR-S polymers, masterbatches and tread stocks, together with corresponding data obtained by means of the Mooney shearing disk viscometer and the Firestone constant-pressure extrusion plastometer, are presented and their relative significance discussed. Twenty-one references are given.

IDENTIFICATION OF NATURAL AND SYNTHETIC RUBBERS. H. P. Burchfield. Ind. Eng. Chem. Anal. Ed. *16,* 424–6 (July 1944). A method is described for the identification of the types of elastomers most frequently encountered in the rubber industry. The initial test depends on qualitative measurement of the pH and specific gravity of the pyrolysis products. It can be carried out in a field laboratory in 3 to 4 min. and will provide sufficient information for a classification of the sample. For confirmatory tests the following are used: 1) the character of the decomposition products, 2) specific gravity, 3) reaction of bromated material with phenols, 4) Prussian blue test for nitrogen, 5) reaction with iodine, and 6) decomposition by sulfuric acid.

PLASTICS DIGEST

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals directly to publishers.

General

THE USE OF SYNTHETIC RUBBERS IN MOLDED PRODUCTS. M. J. Sanger. India Rubber World *110*, 167–71 (May 1944). The properties of synthetic rubber molding materials are described.

ASCORBIC ACID LOSSES IN MINCING FRESH VEGETABLES. C. M. McCay, H. R. Taubken and M. Pijoan. Science *99*, 454–5 (June 2, 1944). Various fresh vegetables containing ascorbic acid (vitamin C), were minced with a plastic knife, a steel knife and a steel chopper. The results show that the loss of ascorbic acid on standing after mincing was less for the samples cut with the plastic knife. Some typical results are as follows: freshly cut green peppers 130 mg./100 gm.; 30 min. after cutting with plastic knife 128 mg./100 gm.; 30 min. after cutting with steel knife 118 mg./100 gm.; 30 min. after cutting with chopper 84 mg./100 gm. Freshly cut cabbage 27 mg./100 gm.; 30 min. after cutting with plastic knife 26 mg./100 gm.; 30 min. after cutting with steel knife 8 mg./100 gm.; 30 min. after cutting with chopper 7 mg./100 gm.

PLASTIC FOUR-WHEELED PASSENGER VAN. The Engineer *177*, 188–9 (Mar. 10, 1944). A passenger van designed and made by the Southern Railway in England is described. The siding of this vehicle consists of fabric-reinforced phenolic plastic panels. The fabric is woven of steel wires and cotton threads. The net saving in weight is 20 percent, and the net increase in capacity is 40 cubic feet.

CHEMICALS FOR RAYON AND CELLULOSE PLASTICS. G. D. Bieber. Chem. & Met. Eng. *51*, 97–9 (July 1944). The large expansion in the production of rayon and cellulose plastics has created an enormous demand for chemicals. In 1933, about 538,000 short tons of refined cellulose, sulfuric acid, caustic soda, carbon disulfide, solvents, acetic acid and acetic anhydride, nitric acid, plasticizers, ammonia, copper sulfate and glycerol were used in the manufacture of these cellulose derivatives. In 1943, the consumption had increased to 1,509,000 tons. During the last 11 years, viscose rayon, cellophane and sausage casings utilized about 78 percent of the chemicals consumed by the industries under discussion. Acetate rayon and cellulose nitrate products each used 10 percent, while cuprammonium rayon and cellulose acetate and cellulose acetate butyrate plastics consumed the remainder. These advances are particularly significant as there are relatively few synthetic organic products made annually in larger quantities than the cellulose derivatives at the present time. Moreover, a market for at least 2 to 3½ lb. of chemicals is generated for each pound of cellulose products that is manufactured.

Materials

THE POLYMERIZATION AND STRUCTURE OF FURFURAL RESINS. W. S. Penn. British Plastics *16*, 286–92 (July 1944). Resins with satisfactory properties are made from furfural. Five types of polymer molecules were formed as a result of the reactions of the 1) double bonds, 2) the aldehyde group, and 3) the 5-hydrogen. The various reactions and structures and evidence for the reactions and structures are discussed. Furfural resins can be made in three stages, *A*, *B* and *C*, as in the case of phenolics. High percentages of fillers may be used satisfactorily with these resins. Casting furfural resins are also made, and they are discussed herein.

LIGNINS AND THEIR PLASTICS. W. S. Penn. British Plastics *16*, 194–8 (May 1944). The chemical structure of lignin is described and the reactions of lignin are explained on the basis of the structure. Possible uses in the synthesis of plastics are discussed.

DERIVATIVES OF SYNTHETIC RUBBER. H. A. Endres. Rubber Age *55*, 361–6 (July 1944). The synthesis and properties of cyclized, chlorinated and hydrochlorinated natural and synthetic rubbers are described. The processes of cyclization, chlorination, and hydrochlorination convert natural rubber into products with great hardness and rigidity, and increased resistance to moisture and corrosive influences. These products have found many uses in protective coatings of the paint and lacquer type, in wire-insulation compositions, as films for packaging food and other products, as paper coatings to reduce moisture penetration and as adhesives. The processes of cyclization and chlorination convert synthetic elastomers into derivatives which differ from the parent product in the following respects: 1) higher specific gravity, 2) higher softening point, 3) greater hardness and rigidity, 4) less flexibility and elongation, 5) greater chemical resistance, 6) lower solution viscosity, 7) lower moisture-vapor transfer, 8) lower moisture absorption, 9) less tackiness, 10) greater solubility in polar solvents.

FUSED METAL RESINATES. J. N. Borglin, P. R. Mosher and H. A. Elliott. Ind. Eng. Chem. *36*, 752–6 (Aug. 1944). Homogenous metal resinates, prepared by the fusion of refined wood rosin, disproportionated wood rosin, commercial hydrogenated rosin, and commercial polymerized rosin with metal diacetates, are found to have the following maximum metal contents: 6 percent calcium, 10 percent cobalt, 8 to 9 percent copper, 29 to 40 percent lead, 6 to 8 percent manganese, or 18 to 23 percent zinc. The pronounced "blocking" (crystallization) tendency of cobalt, manganese and zinc resinates during preparation is overcome by using temperatures as high as 285 to 330° C. to keep the resinate molten, and by adding enough calcium acetate to supply about 0.5 to 2 percent calcium in the resinate. No blocking is encountered with the resinates of polymerized rosin. Cobalt, lead and zinc resinates are prepared with higher metal content than their corresponding metal diabietates — possibly due to the formation of the salts of the metal acetate-abietate type. The homogeneous resinates are amorphous resins and are higher melting than the original rosins. Calcium resinates increase in melting point 20 to 22° C. for each 1 percent calcium; lead and copper resinates increase only 2 to 4° C. for each 1 percent metal. Cobalt, lead and manganese resinates have intermediate melting point rise with metal content. At metal contents which approach the theoretical value, based on acid number of rosin, most of the resinates are completely soluble in organic solvents. Zinc resinates are soluble at metal contents of approximately twice this theoretical value.

Molding and fabricating

KIRKSITE MOLDS FOR PLASTICS. C. C. Sachs. Iron Age *153*, 71–5 (Apr. 20, 1944). The use of cast zinc alloy, Kirksite, molds for forming plastic objects is described. A transfer mold for molding a hook antenna mast from macerated fabric-filled phenolic composition was made by casting the zinc alloy in sand molds. The cores for the sand molds were made of wood and plaster. The greatest difficulty encountered was

the porosity in the region of the cavity; this was remedied by welding and scrapping and by plugging the holes with Kirksite wire. Plaster molds (in place of sand molds) for casting the zinc alloy give a smoother finish. A stub antenna mast die was made by hobbing. Dies for molding laminates are also described. Kirksite has the unique property of not sticking to phenolic and urea plastics. These Kirksite dies for molding phenolics and ureas are satisfactory in service.

LOW-PRESSURE LAMINATING ADAPTABLE TO LARGE PARTS. T. N. Willcox. Product Eng. *15*, 386–8 (June 1944). Design considerations necessary for producing satisfactory large parts by low-pressure laminating are discussed. When ratio of strength to weight is a prime consideration, sandwich-type constructions employing balsa or other low-density core materials may be useful. Working dimensional molding tolerance on thickness is about ±10 percent. Tolerance on lengths and widths can normally be met by molding oversize and trimming to size. Large, thin sections tend to warp and require reinforcement. Moldings are generally smooth on one side and rough on the other. Cylinders may be made smooth on the inside and ground smooth on the outside. The inside radius of a turn or corner should have a minimum value equal to the thickness of the cross-section. External flanges are easy to make; internal flanges are difficult. Tapered ribs and transitions in thickness can be used to increase mechanical strength. Molded holes are a source of trouble; machined holes are preferred. Seams and other irregularities of the rubber bag or blankets transfer to the molded part. A film of cellophane or other thin material can be used between the mold and the surface of the part to reduce adhesion. Common surface defects are blisters, wrinkles, insufficient resin, resin pockets, voids in corners, and improper location of layers and foreign materials. Molding defects are undercure, non-uniform density, crushed, torn or broken fibers, and incomplete resin flow. Some articles may be made in sections and then joined together; such articles are those which are too large for the available equipment or those which are too complex to mold in one piece.

DESIGNING FOR PLASTIC MOLDING. W. M. Halliday. Plastics (London), *8*, 76–83, 129–40, 188–92, 292 (Feb., Mar., Apr., June 1944). The practical designing aspects involved in the development of molded articles are discussed. The features which must be considered to develop a satisfactory plastic mold design are: 1) overall dimensions, 2) general configuration, 3) irregularity of wall thickness, 4) angle of wall inclination, 5) type, extent and number of undercuts, 6) number and size of cored holes, 7) degree of accuracy, 8) type and number of inserts, 9) flash formation and removal, and 10) auxiliary machining operations. Other topics discussed are choice of a suitable molding machine and the proper type of mold.

Applications

PLASTIC-BONDED PERMANENT MAGNETS. Plastics (London) *8*, 274–7 (June 1944). This is a summary of an article by Dehler in "Stahl und Eisen" *62*, 983 (1942). Permanent magnets are made by binding the powdered or ground metallic magnet material with either a phenolic or vinyl chloride resin. Best results are obtained with a resin content of 5 percent. Particle size of the metallic material is important; the maximum possible density gives the best results. Data on the magnetic properties of four samples are reported in detail.

PLASTICS — SOME RECENT DEVELOPMENTS AND INNOVATIONS. W. Nichols. Automobile Eng. *34*, 187–9 (May 1944). Some of the outstanding recent developments in plastics are reviewed. These include floor heating mats, upholstery materials, laminated plastic bodywork and glass-fiber-reinforced plastics.

ADAPTING SYNTHETIC MILITARY FABRICS TO CIVILIAN USES. Textile World *94*, 100–1 (June 1944). Civilian uses for high-strength rayon, glass, nylon, vinyl resin and casein fabrics are postulated. Little difficulty is expected in converting these synthetics from military to civilian uses.

PLASTICS IN THE PLATING INDUSTRY. H. Narcus. Metal Finishing *42*, 401–4, 470–4 (July, Aug. 1944). The types of plastics on the market are reviewed in a general way, and the properties of interest to electroplaters are pointed out. A short discussion on the metal plating of plastics is included. The main factor in plating plastics is obtaining the initial bond coat — usually silver. The plastics are usually depolished, treated with an organic reducing agent and then immersed in ammonical silver solution to obtain a coat of silver. This is followed by an intermediate layer of copper and then the desired metal. Phenolics can be treated with hydroquinone, pyrocatechin and acetone; acrylics with cane sugar, nitric acid, alcohol and water; casein with hydroquinone and *p*-aminophenol; ureas with boiling hydroquinone; cellulose acetate with formaldehyde; and rubber with benzol and acetone.

PLASTIC MATERIAL FOR ELECTROPLATING SHIELDS. H. W. Tompkins. Aero Digest *46*, 109–12, 130 (July 15, 1944). The use of plastic plating shields for masking sections of parts is described. This permits plating only those sections which it is desired to plate with metal and building up certain areas with metal. The main part of the shield is made of a thermosetting resin with a film of thermoplastic material between the resin and the metal to take care of stresses arising from differences in coefficients of thermal expansion.

RESINS AID RECOVERY OF WESTERN TARTRATES. Pacific Plastics *2*, 36 (July 1944). The recovery of tartrates from winery-waste liquors by means of exchange resins is described.

Coatings

THE STATE OF SOLUTION OF HIGHLY POLYMERIZED SUBSTANCES. I. ACTIVITY OF SOLVENTS AGAINST CELLULOSE ACETATE AND CELLULOSE NITRATE AND THEIR MIXTURES. M. Takei. Kolloid Z. *98*, 312–18 (Mar. 1942). The activity factor, the square of the dipole moment divided by the permittivity and the surface tension, of a solvent is important in determining the solvent effect for cellulose esters. Cellulose acetate is soluble in solvents with low-activity factors and cellulose nitrate is soluble in solvents with high-activity factors. This is confirmed by quantitative determinations of solubilities of cellulose esters in a series of alkyl acetates.

TECHNIQUE OF APPLYING HOT DOPES. A. B. Marsh. Aero Digest *46*, 88–9, 146 (July 1, 1944). The technique of applying airplane dopes by means of hot spray is described. The results obtained by spraying hot dopes may vary considerably depending on the care and experience of the operator and the equipment that he is using. Nap-raising is minimized by using an internal mix head on the spray gun or by using an external mix head with an air pressure of 40 p.s.i. to apply the first coat. Intermediate coats are applied at 70 to 90 p.s.i. The fluid-tip and air-cap combination contributes more to the quality of the finished job than any other single factor. The smaller of the recommended fluid tips together with the corresponding air cap should be used.

METHODS AND STANDARDS FOR GLOSS MEASUREMENT OF CAMOUFLAGE MATERIALS. R. S. Hunter. Metal Finishing *42*, 519–22 (Aug. 1944). The methods and standards for gloss measurement of low gloss surfaces are discussed. A procedure for routine measurements of specular gloss is proposed in this article.

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

COPOLYMERS. F. J. Soday (to United Gas Improvement Co.). U. S. 2,352,979–80–1, July 4. Benzene-soluble copolymers of butadiene, cyclopentadiene, and piperylene, with cyclopentadiene.

SCREW. J. J. Tomalis (to American Screw Co.). U. S. 2,352,982, July 4. A screw which is specially designed for plastic materials.

PLASTIC ARTICLES. A. O. Austin and L. W. Austin. U. S. 2,353,000, July 4. Articles are formed from plastic materials by applying an emulsion comprising an aqueous hydrocarbon suspension to the material and forming while the material is dampened with the emulsion.

CELLLOSE ACETATE FILMS. E. Freund and F. Deutsch. U. S. 2,353,023, July 4. Cellulose acetate film containing residual solvent is stretched and immersed in aqueous medium within the temperature range of spontaneous extension, said range depending on the composition of the aqueous medium which has a limited swelling effect on the resin.

SCREEN. C. Dreyfus. U. S. 2,353,-224–5, July 11. A window screen composed of filaments of cellulose ester.

POLYSTYRENE. F. W. Ducca (to Bakelite Corp.). U. S. 2,353,228, July 11. A molding composition comprising polystyrene and a polyalkylene oxide as a lubricant.

CELLULOSE ACETATE. C. J. Malm and L. W. Blanchard, Jr. (to Eastman Kodak Co.). U. S. 2,353,255, July 11. In the preparation of cellulose acetate, phosphoric acid is added at the point of maximum temperature during the acetylation process.

FIBERS. E. W. Rugeley, T. A. Field, Jr. and J. F. Conlon (to Carbide and Carbon Chemicals Corp.). U. S. 2,353,-270, July 11. Textile fibers are formed by extruding a dispersion of vinyl resin through an orifice, drying in a dry atmosphere, delustering with water, aging in water at 50° C., stretching in water at 50° C., softening by flexing under water.

EXTRUSION MOLDING. W. C. Rudd (to Induction Heating Corp.) U. S. 2,353,362, July 11. An extrusion device supplying plastic material liquefied by means of high-frequency heating.

BAG. A. B. Haslacher. U. S. 2,353,402, July 11. Bags are prepared from flattened tubes of thermoplastic material by heat sealing.

CELLULOSE ESTERS. J. S. Tinsley (to Hercules Powder Co.) U. S. 2,353,-423, July 11. In the mixed esterification of cellulose with acetic acid and a 3 to 6 carbon fatty acid, the reaction is initiated in the presence of less than 50 percent of the total acetyl groups, the remaining percentage being added over a prolonged period.

RESIN. G. A. Goessling. U. S. 2,353,457, July 11. A molded heterogeneous mixture of two clear incompatible thermoplastic resins having a pearl-like luster.

SAFETY GLASS. L. D. Keslar (to Pittsburgh Plate Glass Co.). U. S. 2,353,473, July 11. Safety glass is prepared by assembling glass plates and interposed plastic sheets, applying molding frames to each side of the assembly, and pressure heating in a rubber bag.

TRANSFER PROCESS. C. S. Frances, Jr. and W. Wade (to Sylvania Industrial Corp.). U. S. 2,353,717, July 18. A surface is coated with a synthetic resinous film, which is releasably attached to a backing sheet, by means of transfer.

ORNAMENT. M. C. Meyer. U. S. 2,353,744, July 18. A simulated pearl comprising a plastic sphere coated with pearl essence dissolved in a solvent for the plastic.

INJECTION APPARATUS. V. E. Hofmann (to Owens-Illinois Glass Co.). U. S. 2,353,825, July 18. An injection machine for thermoplastic materials, including a parison mold and also some finishing molds.

ABRASIVE. C. E. Wooddell (to Carborundum Co.). U. S. 2,353,864, July 18. An abrasive article comprising an abrasive body secured to a backing plate composed of layers of felted fibers impregnated with thermosetting resin which is fully cured.

COATING. W. P. Lawler, G. J. Hable and J. V. Steinle (to S. C. Johnson and Son, Inc.). U. S. 2,353,910, July 18. A coating consisting of a vinyl ether of an alcohol having 10 to 35 carbon atoms, an alkyd resin modified with an oxidizable unsaturated fatty acid, and an organic solvent.

FILLERS. C. E. Boutwell. U. S. 2,353,991, July 18. Fillers are added to plastic material by grinding with a solution of the plastic at sub-atmospheric pressures and evaporating the solvent.

MOLDED ARTICLE. B. F. Conner (to Colt's Patent Fire Arms Manufacturing Co.). U. S. 2,353,995, July 18. A molded clear transparent synthetic resin in which solids are embedded.

MOLDING. B. A. Cooke and L. W. Gane (to Columbian Rope Co.). U. S. 2,353,996, July 18. A thermosetting resin containing a vegetable-fiber filler is molded by confining between a rigid member and a rubber member in the presence of heat and pressure, the surface of the rubber member being submerged in a liquid of low-heat conductivity.

SIEVE. E. Hubert and H. Rein (to Alien Property Custodian). U. S. 2,354,-022, July 18. A sieve comprising stretched threads of a synthetic organic polymer which are woven and heat shrunken.

MOLDING PRESS. A. W. Kingston. U. S. 2,354,029, July 18. A rotary molding press for thermoplastic materials.

PRACTICE BOMB. H. W. Mitchell. U. S. 2,354,039, July 18. A practice bomb comprising a body of paper stock and a nose molded of a plastic material.

PLYWOOD. A. J. Stamm and R. M. Seborg (to Secretary of Agriculture). U. S. 2,354,090, July 18. A dense compressed permanently water-resisting product comprising wood plies impregnated with phenol-formaldehyde resin and cured with heat and pressure.

BINDING. C. W. Thomas (to Keystone Index Card Co.). U. S. 2,354,094, July 18. A notebook binder comprising paper impregnated with a thermoplastic material.

COMPOSITE. J. G. Ford and R. D. Spencer (to Westinghouse Elec. and Mfg. Co.). U. S. 2,354,110, July 18. A material composed of cured phenol-aldehyde resin and glass fibers, coated with polyvinyl acetate-formaldehyde.

ANION EXCHANGE UNIT. R. J. Myers and D. S. Herr (to Resinous Products and Chemical Co.). U. S. 2,354,-172, July 18. An anion exchange unit comprising a synthetic resin.

ACRYLIC POLYMER. R. A. Jacobson (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,354,210, July 25.

Acrylic compounds are polymerized in the presence of an N-chlorinated hydantion.

MOLD. V. S. Anderson. U. S. 2,354, 241, July 25. A mold for plastic articles which is equipped with a cutting edge which renders it self-trimming.

ORIENTATION METHOD. R. P. Blake (to Polaroid Corp.). U. S. 2,354,-243, July 25. Sheets of plastic material, wherein the molecules are oriented, are prepared by depositing on an endless belt moving at a controlled rate of speed.

CHECK VALVE. D. E. Gillum and D. H. van Riper. U. S. 2,354,255, July 25. A valve made up of a hollow body connected to a threaded pipe and containing a movable ball which serves as a valve. All portions of the structure are composed of a plastic material.

CELLULAR MATERIAL. C. I. Haney and M. E. Martin (to Celanese Corp. of America). U. S. 2,354,260, July 25. Cellulose derivatives are dissolved, the solution heated under pressure at a temperature above the solvent boiling point, and the pressure suddenly released. The result is the formation of a low-density cellular structure.

MOLDING. A. A. Burry. U. S. 2,-354,363, July 25. A heating chamber for melting thermoplastic material prior to injection molding.

COMPOSITE. R. C. Briant (to Firestone Tire and Rubber Co.). U. S. 2,-354,426, July 25. A composite article is prepared by impregnating cellulosic fabric with an aqueous solution of a rubber and a water-soluble phenolic resin, drying, heating for 1 hr. at 100°C., and finally heating in contact with a vulcanizable rubber composition.

FABRIC. T. W. Stedman (to Firestone Tire and Rubber Co.). U. S. 2,354,435, July 25. A fabric woven from a plasticized vinylidene chloride copolymer.

MOLDING COMPOUND. F. Rosenthal (to University of Tennessee Research Corp.). U. S. 2,354,479, July 25. A molding composition comprising a phenolic resin and leather-scrap filler.

MOLDED ARTICLE. C. E. Slaughter (to Extruded Plastics, Inc.). U. S. 2,354,485, July 25. A molded object comprising two sections. One section has a beaded edge; the other a grooved edge so designed that the beaded edge may be inserted in the groove in order to form a swivel joint.

AMINOPLAST. G. F. D'Alelio (to General Electric Co.). U. S. 2,354,504, July 25. An aminoplast plasticized with an aryl compound containing a sulfonamide group and a ureido radical, or plasticized with an aldehyde reaction product of such a compound.

COATING. T. F. Bradley (to American Cyanamid Co.). U. S. 2,354,572, July 25. A coating material prepared by heating an oxygen-convertible alkyd resin with oxygen until viscous, mixing with filler, and finally heating to cure.

PLASTIC. H. W. Greider and G. A. Fasold (to Philip Carey Manufacturing Co.). U. S. 2,354,593, July 25. An article comprising a plastic binder and a fiber filler.

NITROGENOUS RESIN. J. W. Eastes (to Resinous Products and Chemical Co.). U. S. 2,354,671, August 1. An anion exchange resin comprising the reaction product of a polynuclear methylol-forming phenol, having phenylol groups joined through sulfur to an alkylene polyamine, and formaldehyde.

NITROGENOUS RESIN. J. W. Eastes and C. Averill (to Resinous Products and Chemical Co.). U. S. 2,354,672, August 1. An ion exchange resin comprising the reaction product of a catechol and an alkylene polyamine and formaldehyde.

HEAT SEALING. H. A. Strickland, Jr. (to Budd Wheel Co.). U. S. 2,354, 714, August 1. Similar pieces of plastic material are sealed by impressing high-frequency electrodes on either side of the seal, the potential being less than that required to effect breakdown of the dielectric strength of the layers.

SHAPED ARTICLES. C. Dreyfus. U. S. 2,354,744–5, August 1. Artificial shaped articles are prepared from fusible films or fibers of vinyl ester resins or cellulose derivatives at high temperatures followed by a rapid cooling.

TERPENE RESIN. A. L. Rummelsberg (to Hercules Powder Co.). U. S. 2,354,775–6, August 1. Resinous products are prepared by reacting a terpene with a vinyl compound or with a rosin or rosin derivative.

SHUTTLECOCK. B. O. Beck. U. S. 2,354,790, August 1. A shuttlecock composed of plastic materials.

CHLORINATED DIPHENYLS. R. L. Jenkins (to Monsanto Chemical Co.). U. S. 2,354,813, August 1. Chlorinated diphenyls free of nitro groups are prepared by direct chlorination of mononitrodiphenyl in the presence of a metal halide and heat.

ALKALI CONTAINER. I. E. Muskat (to Pittsburgh Plate Glass Co.). U. S. 2,354,824, August 1. A metal container coated with an alkali-resistant benzene-soluble composition of ethyl cellulose and polystyrene.

CLOSURE. E. C. Emanuel (to Armstrong Cork Co.). U. S. 2,354,855, August 1. A container closure containing a sealing element of polyvinyl chloride attached by means of an adhesive mixture of hydrogenated rosin, polyisobutylene and a terpene polymer.

MOLDED OBJECT. J. A. Gits and J. P. Gits. U. S. 2,354,857, August 1. A transparent object having a smooth convex front face and, on the rear face, a design formed by recesses which are coated with an opaque material.

EMBOSSING. V. H. Hurt (to U. S. Rubber Co.). U. S. 2,354,916, August 1. A method and apparatus for embossing sheets of plastic material.

PLASTIC. S. Musher (to Musher Foundation, Inc.). U. S. 2,355,033, August 1. A plastic composition comprising the heat-plasticized fraction of dehulled oats.

PLASTIC. M. de B. Remy. U. S. 2,355,180, August 8. A thermoplastic compound is prepared by forming an alkaline solution of lignin and a solution of wheat gluten of the same pH, mixing the two solutions, and finally coagulating the mixture by the addition of an acid.

POLYMER. R. S. Schreiber and J. H. Werntz (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,355,245, August 8. A water-soluble high polymer of an alkyl glucoside.

CELLULOSE DERIVATIVES. S. Petersen and K. Taube (to Alien Property Custodian). U. S. 2,355,326, August 8. Cellulose or its alkyl, aralkyl, or acyl derivatives which contain hydroxyl groups are co-dissolved with polyesters of polybasic organic acids and heated to effect reaction.

WELT INSOLE. W. C. Wright. U. S. 2,355,383, August 8. A welt insole for shoe and boot structures composed of resilient plastic material.

RESIN. S. Sussman (to Permutit Co.). U. S. 2,355,402, August 8. An ion exchange resin made up of the reaction product of an aldehyde and a nitroparaffin.

CELLULOSE ESTERS. W. H. Holst (to Atlas Powder Co.). U. S. 2,355,533, August 8. A composition comprising a cellulose ester and a hexitol tributylidene.

PRESS. G. W. Wacker (to Clearing Machine Corp.). U. S. 2,355,613, August 15. A molding press for plastic materials.

CELLULOSE ESTERS. H. Dreyfus (to Celanese Corp. of America). U. S. 2,355,712, August 15. Cellulose is esterified with a lower fatty acid anhydride in the presence of sulfuric acid, precipitated, redissolved and finally ripened in solution.

BOOKS AND BOOKLETS

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent post-paid at the publishers' advertised prices.

Infrared Spectroscopy

by R. Bowling Barnes, R. C. Gore, U. Liddel and V. Z. Williams

Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y., 1944

Price $2.25 — 236 pages

The selective absorption of infrared rays by organic compounds has been used by physicists to probe into molecular structure and to identify materials. This experimental tool has been especially useful in investigations in the field of high polymers. In this pioneering publication, the authors present a discussion of the theoretical aspects of the subject, a 61-page library of reference curves, and a bibliography of 2701 infrared research papers. G.M.K.

Soybean Chemistry & Technology

by K. S. Markley and W. H. Goss

Chemical Publishing Co., Inc., 26 Court St., Brooklyn, N. Y., 1944

Price $3.50 — 261 pages

Part I of this book pertains to the composition and properties of the various constituents of the soybean. Part II surveys the methods used in processing the bean to obtain the oil, flour and phosphatides used in food products.

Glue and Gelatin

by Paul I. Smith

Chemical Publishing Co., 26 Court St., Brooklyn, N. Y.

Price $3.75 — 145 pages

The raw materials, manufacture, and application of the protein adhesives based on the by-products of hide are reviewed in this book. Miscellaneous applications of these by-products for other industrial purposes are also described. G.M.K.

★ STEPS IN THE CASTING OF A thermoplastic material for forming tools are discussed in "Tenite II Casting," a booklet recently published by Tennessee Eastman Corp., Kingsport, Tenn. Issued for the benefit of tool engineers, the booklet should be of interest to aviation companies and industries engaged in the forming of sheet metal. A detailed description of casting procedure is included and the particular advantages of this material.

★ A NEW DEVELOPMENT IN fabric reinforced thermosetting plastic, V-Board, is discussed in a brochure published by United States Rubber Co., Mishawaka, Indiana. Thus far, the most important use for this material has been as a protector of bullet-sealing fuel tanks on airplanes. Yielding at first to the impact of the bullet, V-Board quickly recovers and assumes its normal position thus affording the wounded cell an opportunity to heal itself. This material is said to be comparable in strength to many metals and far lighter than aluminum. Although any woven fabric may be used as a reinforcing medium, duck and Fiberglas are used to a large extent for war applications.

★ THE SOCIETY OF THE PLASTICS Industry, Inc., Los Angeles, Calif., has published an 82-page booklet on its Pacific Coast Section. A short history of the society and a review of its functions are followed by a list of the members of this Chapter — molders, laminators, extruders, fabricators, materials suppliers machinery manufacturers and consultants. An alphabetical "Who's Who in Plastics — Pacific Coast Section," the names of the officers and directors of the Chapter and its by-laws complete the book.

★ A BASIC TEXTBOOK ON THE properties and uses of soluble nitrocellulose has been published by Cellulose Products Dept., Hercules Powder Co., Wilmington, Del. The book contains a discussion of the history of nitrocellulose and covers manufacture, types, solubility, viscosity and other pertinent information on the properties of the material. In the section on uses, its application in lacquers, coated textiles, plastics, adhesives and inks are discussed. Tables and charts are included to clarify.

★ IN AN 8-PAGE PAMPHLET ENtitled "What Material?" Continental-Diamond Fiber Co., Newark, Del., suggests that you let them fit the material to your task and lists universal basic materials and their properties.

★ A 4-PAGE FOLDER, DISTRIButed by Industrial Oven Engineering Co., Cleveland, Ohio, lists engineering details of the company's constant-tension wind-up machine for wire, cable, rubber, tapes, fabrics and other materials produced in continuous lengths.

★ A NEW 12-PAGE ILLUSTRATED catalog, "The Process of Extruding," containing comprehensive data for industrial engineers and designers on the process of extruding and the products that can be made thereby, has been issued by B. F. Goodrich Co., Akron, Ohio. Method of production, basic needs in the production of good extruded articles and suggestions for combining different materials to produce a reinforced part, are subjects covered in the booklet.

★ THE BIRTH AND HISTORY OF Plaskon are reviewed in a new booklet published by Plaskon Div., Libbey-Owens-Ford Glass Co., Toledo, Ohio. Practical application of this material to many needs of industry are demonstrated, and each resin is described in detail as a means of encouraging correct application of plastics to specific requirements. Plaskon resin glue, used in bonding of wood, paper, fabrics, cork and compositions, is covered in one section of the text.

★ A FOUR-PAGE PAMPHLET ON Megatherm high-frequency heating of preforms has been released by Industrial Electronics Div., Federal Telephone and Radio Corp., Newark, N. J. The units are illustrated and the advantages of this method are listed.

★ ELECTRIX CORP., PAWTUCKET, R. I., has issued a booklet describing the equipment in their toolshop. Two pages are devoted to each department—illustrating and listing the machines used. Another section covers examples of work that has been turned out.

★ SECTION 8 OF THE HANDbook, "Technical Data on Plywood," covering the subject, "The Design of Flat Panels with Stressed Covers," has been released by Douglas Fir Plywood Association, Tacoma, Wash.

★ TWO BOOKLETS, NO. 230-A and No. 330-A, have been received from Watson-Stillman Co., Roselle, N. J. No. 230-A covers direct-stem and flush-mounted gages for use on hydraulic presses and pumps where accurate, trouble-free indication on hydraulic pressures is essential. No. 330-A describes a general-utility vertical-horizontal press. The convertibility feature of this press provides for either horizontal or vertical forcing, forming, straightening and bending operations.

HARDESTY CHEMICAL COMPANY

announces volume production of

PLASTICIZERS

that may be just the ones you're looking for

A study of these chemicals manufactured by Hardesty Chemical Company may suggest to you a possible use in solving your production problems.

• • •

SEBACIC ACID

Specific gravity	1.085 25/15°C
Melting point	128°C
Neutralization equivalent	102
Free fatty acid	98.5%
Moisture	0.15%
Mol. weight	202.14

BUTYL ROLEATE

Free fatty acid	2%
Butanol	0.2%
Moisture	0.2%
Color	Red

CAPRYL ALCOHOL

Specific gravity	0.815/20°C
Mol. weight	130.23
Flash point	172°F
Distillation range	176.8/179.9°C
Refractive index	1.4266 @ 20°C
Lbs. per U.S. gallon	6.81
Boiling point	178/179°C
Moisture	0.25%

DIBUTYL SEBACATE

Purity	98.5% Minimum
Specific gravity	0.935 20/20°C
Acidity as Sebacic	0.3% Maximum
Color	15Y, 3.5R
Butanol	0.1% Maximum
Flash point	380°F
Boiling point	344°C. @ 760 mm. 177–180°C @ 3 mm.
Water solubility	Less than 1% @ 25°C
Freezing point	11°F
Weight per gallon	7.8 lbs.
Index of refraction	1.4391 @ 25°C
Dielectric constant	3.6
Power factor—60 cycles	6

• • •

Send for samples and additional information

HARCHEM

HARDESTY Chemical Co., Inc.

41 EAST 42nd STREET • NEW YORK 17, N.Y.

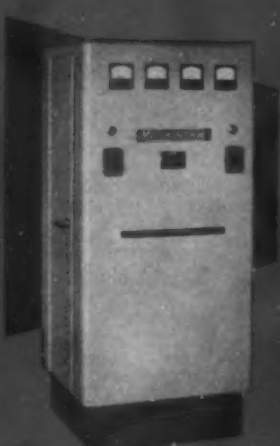
COMPLETE PLASTICITY!

-MEGATHERM-*

CUTS MOLDING TIME 90%

▲ *The molded handset ready for ejection from the mold after the 30 second perfect cure.*

◄ *Megatherm heated preforms in press transfer chamber just before closing.*



Federal Industrial Power Tubes, give power and performance to Megatherm and other industrial heating equipment.

Molding time on these telephone handsets was reduced from five minutes to 30 seconds with Megatherm.

In addition to rapid molding Megatherm provided a complete and uniform cure which was free of all internal stress.

Megatherm is doing plastic preform heating *better* and *more quickly* than any other method. In many cases Megatherm has made a plastic molding job possible which could not be done by other methods.

Megatherm units are compact, and may be easily moved from one production line to another. One of the four standard models will fit your production needs. Megatherm is available in 3 KW, 7 KW, 15 KW and 25 KW output capacities.

Cost of operation is low; the popular 3 KW Megatherm has a power cost of 5¢ per hour.

If you have a plastic preheating problem, now is the time to talk about it with Federal.

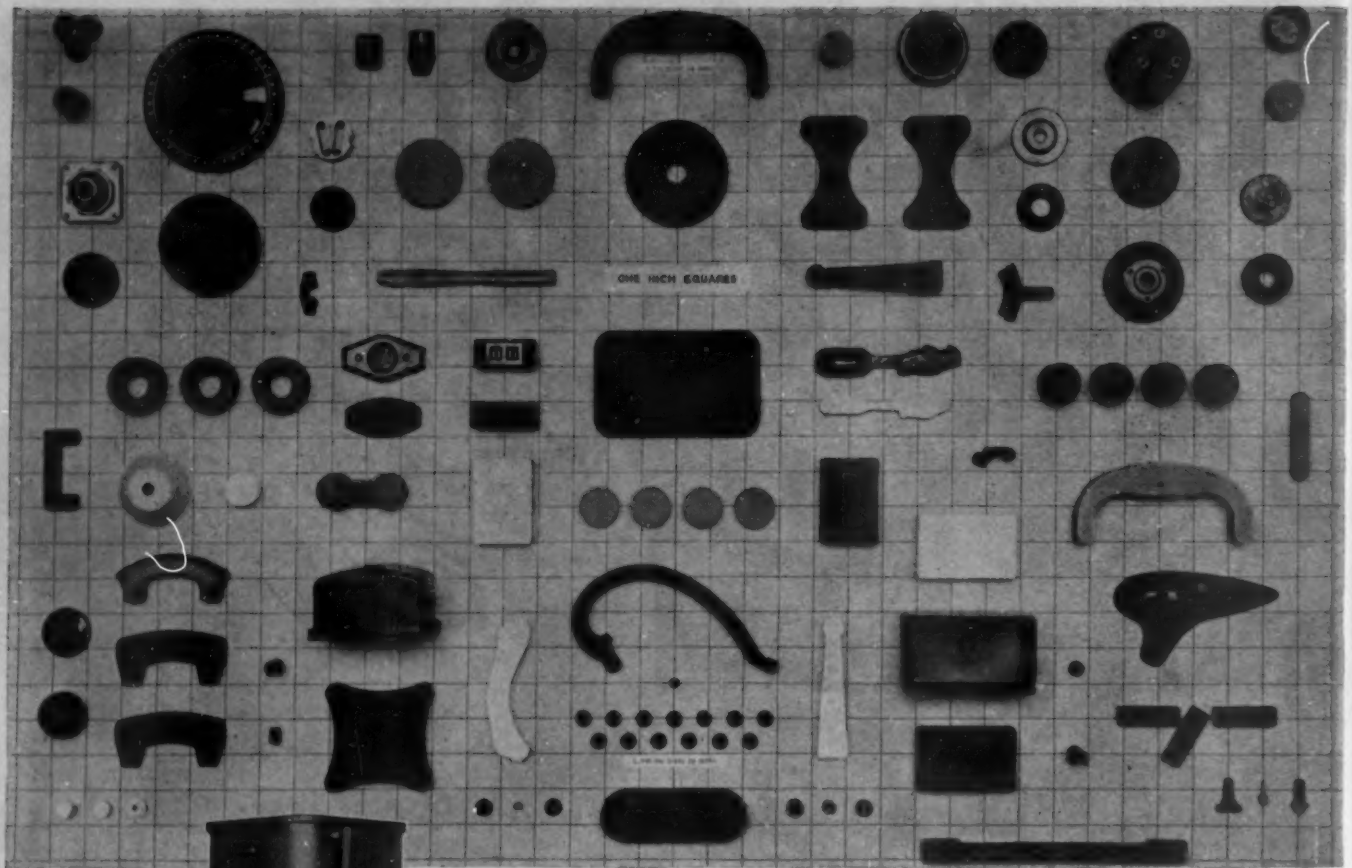
Federal Telephone and Radio Corporation

INDUSTRIAL ELECTRONICS DIVISION

Newark 1, N. J.

AN IT&T ASSOCIATE

*REG. U. S. PAT. OFF.



WIDE RANGE OF

Shapes and Sizes

● Big pills . . . little pills . . . tablets in a *wide variety of shapes and sizes* can be produced on the Defiance Plastic Preforming Machines. Weights of preforms can be rapidly changed—without even stopping the machines. Designed to reduce die cost. Tools can be quickly interchanged.

Greater Cleanliness with these machines—and a minimum of "down time" for cleaning—because it's easy to change colors. Material leakage during operation reduced to a minimum.

Greater Uniformity in weight and density—with high speed production—assured by exclusive features of Defiance design. This keeps waste and costs *down*—efficiency *UP!* Do your plastic preforming *better* with Defiance! Write for more facts. Defiance Machine Works, Inc., Defiance, Ohio.

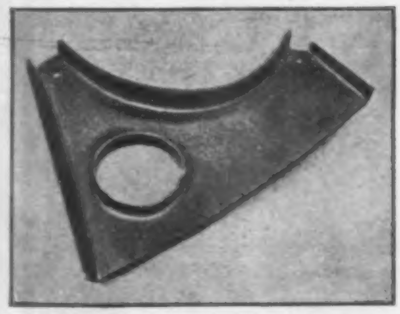
DEFIANCE

Plastic Preforming Presses

POST FORMED PHENOLITE*

Opens wide avenues for your successful Post-War Products

*A formable thermosetting sheet material—makes parts more resistant to shock



This is a typical Post Formed Phenolite baffle used in aircraft construction.

Post Formed Phenolite parts are playing an important role in today's airplane construction because of their ability to withstand tremendous impact without fracture. This impact strength is approximately ten times that of usual molded parts.

This remarkable property, combined with Phenolite's other exceptional characteristics—resistance to wear and moisture, light weight (about one-half the weight of aluminum), excellent electrical insulator—recommends the broad advantageous use of Post Formed parts in countless peacetime products.

Post Formed Phenolite Parts are economical to produce. The sheet is heated to forming temperature (a matter of seconds). After heating, it is formed in an inexpensive wooden mold with standard press equipment. Practically any desired form or shape may be achieved. Forming takes place in a few minutes. There are no rough edges to be sanded—no flash to be removed. Fabrication may be done before or after forming.

Just now we can supply material for war applications only, but our technical men will be glad to work with your engineers on your peacetime projects. Write us now on Post Formed Phenolite.

NATIONAL VULCANIZED FIBRE CO.

Wilmington, Delaware *Offices in Principal Cities*

FRANKLY IT SCARES US...

The .45 GI automatic in plastic is so realistic that it frightens even army officers until they get a good look at it. It is not a toy. It is a training weapon designed to give soldiers a facsimile arm without wasting a lot of material, manpower and money. It teaches our boys how to approach an enemy with a firearm, how to disarm him while guarding against injury.

We prefer to make things like the horn button and the other automotive ornaments. They are our style. The more pistols and war goods we can turn out, however, the quicker we will be able to go back to making beautiful three-dimensional designs and other consumer items.

Cruver

MANUFACTURING COMPANY

NEW YORK
2 West 46th St.
Wisconsin 7-8847

CHICAGO
2456 W. JACKSON BLVD.
Seeley 1300

WASHINGTON
Hotel Washington
Met. 5-900, Ext. 650

SPECIALISTS IN CONVERTING PLASTICS TO WAR

LEADERS IN POST-WAR PLANNING, TOO

The ONLY Plastic with a continuous re-enforcement of long, resilient ROPE FIBRES

Produces Compound Curves, Deep Draws, Angles, Channels and Large Shells with a Minimum of Preparation, "Lay-Up" and Curing Time.

● Quickly and easily cured in high pressure, low pressure, fluid pressure, flash and transfer molds, Co-Ro-Lite provides an interlocking continuity of re-enforcement in any size piece, from the smallest up to the largest that can be accommodated in production-type autoclaves.

It is a production success—proved in hundreds of difficult applications, and backed by more than 40 years of "know how" in selecting, processing and fabricating tough cordage fibres for industrial, marine and farm use.

CO-RO-LITE provides complete physical, chemical, design and pilot-plant service. Tell us your problems. Let our technical experts and industrial designers help you to solve them. Write today for latest handbook giving properties, possibilities and advantages of Co-Ro-Lite.

ARMY E NAVY

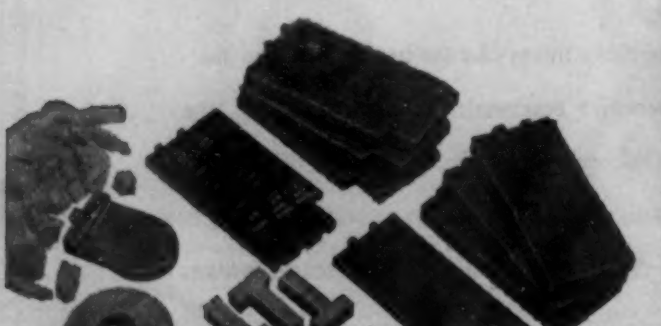
ALLIED PRODUCTS DIVISION

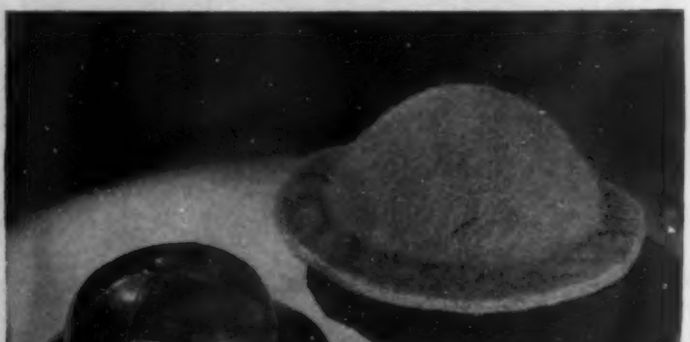
COLUMBIAN ROPE COMPANY

AUBURN, "The Cordage City", NEW YORK

Canadian Licensee, Canadian Bridge Engineering Company Ltd., Box 157, Walkerville, Ontario, Canada

*Process patented; trademark registered in U. S. Pat. Off.





ENGINEERING ABILITY

One of Many Reasons Why Amos Jobs are Done Right

● Above you see a part of the Amos engineering department, where men with exceptional ability design the plastic part or product for practical utility—for functional use—for dependable performance—and for fine appearance if desired. In the picture you see J. C. Kazimier, chief engineer, checking a job on one of the boards.

Amos does a complete job—and does it right—from engineering to finishing. The right plastics are used in the right places—combined with metal inserts and other materials as required. Designers develop models for approval. Dies and fixtures that produce perfect jobs are built in our own shops. Every detail is worked out precisely—and uniformity of size and fit and tolerances required are assured by quality control stations throughout production and finishing departments.

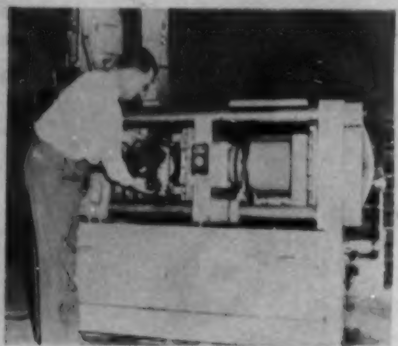
You'll appreciate our engineering service and our complete facilities for doing your job the way you want it done. Just send us your drawings or write us what you have in mind.

AMOS MOLDED PLASTICS, EDINBURGH, INDIANA

Division of Amos-Thompson Corporation

NEW MACHINERY AND EQUIPMENT

★ A CONTINUOUS INJECTION molding and extruding machine which employs a worm screw similar to those found in coal furnace stokers has undergone extensive experiments in the Engineering Laboratories of Chrysler Corp., Detroit, Mich., and has shown that it can step up the wartime manufacture of many thermoplastics and thermosetting plastics, and real and synthetic rubber articles. According to the company, the range of plastic and rubber parts and articles—in much larger sizes than realized under previous manufacturing methods—is very



great. The machine has produced an item as large as a plastic battery case in less than 5 min., using 128 oz. (8 lb.) of thermosetting plastics. In less than 3 min., one of these machines (above) installed at Monroe Auto Equipment Co., Monroe, Mich., has produced at one molding as many as 144 rubber insulators. It is also capable of producing precision rubber parts for airplane motors and other war products. In the tubing field the machine has enormous possibilities.

The continuous injector consists of a simple hopper holding plastics or rubber. The materials are fed to a heating cylinder where a special churning apparatus keeps them evenly mixed. Then the putty-like substances, under screw pressures up to 22,000 p.s.i., are shot through a nozzle clamped to an opening where the die plates join. When the plastics, or the rubber, have filled the mold, or series of molds, the back-pressure automatically shuts off the feeder. Because of the uniform feed and even mixture of materials, the curing time has been cut and waste has been greatly reduced.

★ JAS. H. MATTHEWS AND CO., Pittsburgh, Pa., has designed a new method for marking delicate and precision parts that have a ground or mirror surface which must not be marred or distorted. The marking is accomplished by means of a short blast of fine grit material against the rubber or celluloid stencil masks upon which the part is placed. The unit is constructed for very fine work and operates most successfully on a volume of air at low pressure—5 to 8 lb. at the nozzle—and requires about 30 cu. ft. of air per min. The "Airgrit" unit is equipped with an electric solenoid valve and a timing unit. The masks can be furnished in celluloid, patented rubber or rubber-covered brass in sizes from 0.055 to 0.75 inch.

★ A NEW MELTING TANK FOR thermosetting plastic, fully jacketed and electrically heated, is facilitating production of airplanes and parts at Goodyear Aircraft Corp., Akron, Ohio. Forced air circulated through the kettle's jacket to obtain the required cooling of the material before pouring is said to speed the processing cycle. The tank is made of $^1/_2$-in. boiler plate, insulated with a jacket of rock wool, and the plastic is stirred by a spiral agitator. Heaters are arranged in groups to allow for varying depths of different melts.

★ F. J. STOKES MACHINE CO., Philadelphia, Pa., announces a fully automatic 50-ton plastics molding press which operates on the hydraulic principle. This unit, No. 235 Press, has several new features, among which are a patented sensitive "trap" or checking device which is said to be sensitive to a fraction of a gram; multiple-feed with micrometer adjustments for capacities up to 48 cu. inches. New simplified ejection and knockout systems are designed to operate in connection with the feed device and are governed by a patented timing control unit. The low cost of operation of this self-contained and electrically powered and heated press is indicated by the fact that only a 2-hp. motor is necessary to develop full 50-ton pressure capacity.

★ NORTHMASTER DIV., STRUTHers Wells Corp., Titusville, Pa., claim several important advantages for their new batch-type shredding and mixing machine. The tendency for moistened pulp to collect in the corners of the trough above the blades and escape treatment is said to be minimized by the action of improved mixing blades in combination with a serrated saddle and specially constructed mixing chamber. Through elimination of large corner fillets, the jacket area is substantially increased. These machines are constructed of any commercial metal or alloy, and are now available in sizes up to 4000 gallons.

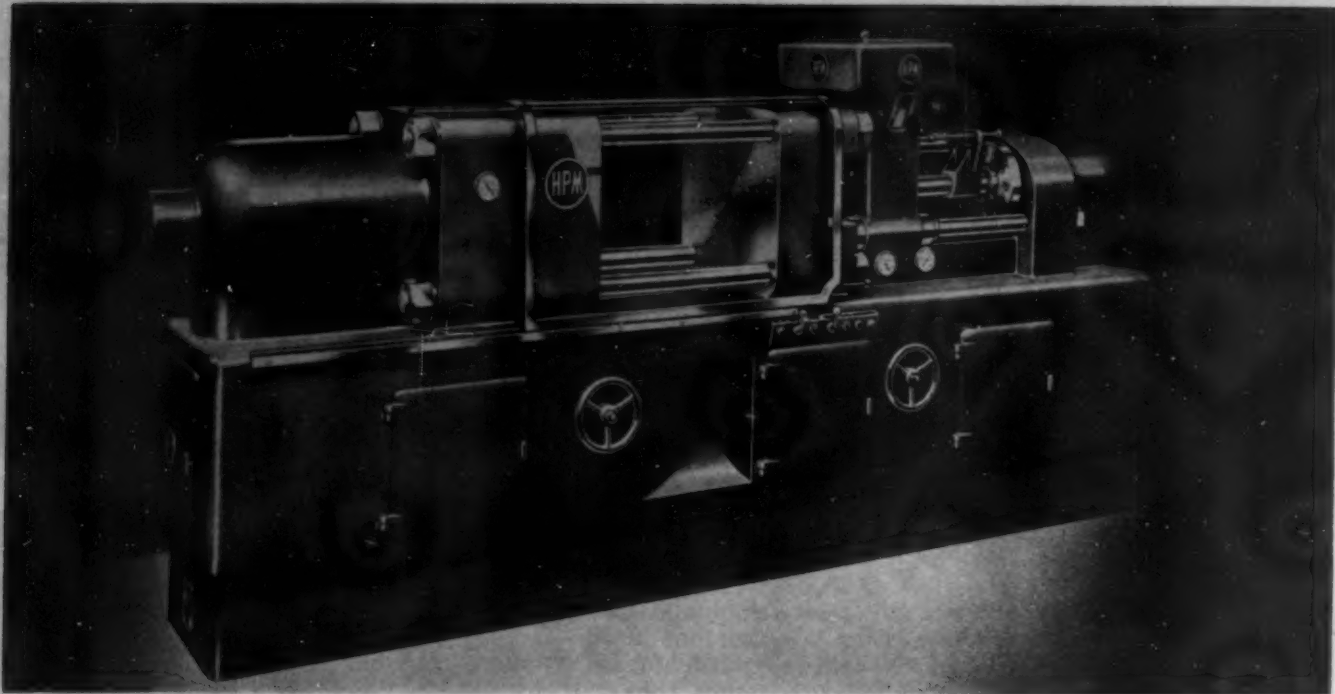
★ MANDERSCHEID CO., CHICAGO, Ill., claims quick and easy changing of wheels without wear to spindle and without risk to operator as advantages of Presto polishing wheel bushings. The spindle need not be run for the changing of polishing wheels equipped with these bushings and the wheel is kept concentric, assuring uniform contact all around the wheel. The bushings are pressed into the wheel by the use of a polishing lathe spindle and notches hold them in place, preventing the turning.

★ THE PRINCIPLE OF HIGH-FREquency current was used by Richardson-Allen Corp., New York, N. Y., in designing a machine for welding thermoplastics. High-frequency current, created between two electrodes in the forming of rotating wheels or bars, inducts heat into the mass of material as it passes between the electrodes. Any degree of pressure may be introduced to complete the weld while the materials are in the desired plastic state. The machine resembles an ordinary sewing machine, but the welder can be modified to other forms.

★ MINNESOTA MINING AND MFG. Co., St. Paul, Minn., has developed a new abrasive strip for finishing oil holes in hard-to-get-at areas. The strip is constructed of Elek-Tro-Cut Three-M-ite cloth, and the center is reinforced so that it can be bent over and threaded through any troublesome opening. The strip is available in a wide range of grits, in diameters of $^1/_{16}$ to $^1/_4$ in., and in lengths of about 4 to 12 inches.

★ SAW-CHIEF, A NEW ATTACHment for electric drills, has been announced by Chicago Precision Equipment Co., Chicago, Ill. When an ordinary hack-saw blade is placed in the holder with the teeth toward the operator, it is said that the device will saw into every kind of plastics, wood, metal or other material. By substituting a file for the saw, the unit may be converted into an automatic file. The machine may be attached to any electric drill with a $^1/_4$ in. chuck and may be obtained with or without a heavy-duty electric drill.

★ A VERSATILE CUTOFF MAchine, Di-Met Model 80, is being produced by Felker Mfg. Co., Torrance, Calif., for use with Di-Met rimlock, metal-bonded and resinoid-bonded diamond abrasive wheels. Within its capacity, the unit is said to be adaptable to all types of precision and production cutoff work on laminates and thermosetting plastics, and on many other types of material. Variations available for use on the machine include a 7-in. rotary table equipped with both cross and through feeds and manually operated through-feed for use with a rolling table.



1—The new Model 350-H-16 plastics injection molding machine for the injection molding of thermoplastic materials. This machine, which incorporates many new design features, has a rated capacity of 16 ounces per cycle

New 16-oz. injection machine

THE Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio, announces the completion of a new 16-oz. capacity injection-molding machine for the injection molding of thermoplastic materials. This new machine incorporates many new design features and represents one size of a new postwar line of "all-hydraulic" injection-molding machines.

Specifications

The hydraulic mold clamp consists of a double-acting ram, fitted with metallic piston rings, working in a smooth bored-steel cylinder. The main ram is equipped with a small internal booster ram of a new improved design. The booster ram, operating at a comparatively high speed, closes the clamp platen to within a fractional part of an inch of the total clamp stroke. At this predetermined position, hydraulic fluid under pressure is shifted to the large ram area. This arrangement permits practically all of the clamp travel to be accomplished by the use of the fast-closing booster ram. Forward mold-clamp ram travel is controlled by a hydraulic bypass arrangement which eliminates the need of stop collars on the tie rods. The return stroke of the mold clamp is adjustable to any position within the maximum limits of the clamp ram travel, thus allowing the shortest possible clamp movement.

The die head is a solid steel forging arranged so that it can be moved forward hydraulically—permitting automatic retraction of the mold from the nozzle tip, an action which breaks the sprue. The arrangement also makes it possible for the plastic material to be injected into the atmosphere without entering the mold, thus allowing operator to eject partially hardened material from the nozzle of the machine if it is necessary. The hydraulic injection unit is equipped with a double-acting ram working in a smooth bored steel cylinder.

The injection chamber whose internal surfaces are chrome plated, is mounted on a steel cradle which is held in accurate alignment by two tie rods. The position of the cradle is adjustable to accommodate heating chambers of various lengths. The unit is designed with a new interrupted-wedge locking device that makes it possible for an operator to remove the chamber by simply turning it 60 degrees.

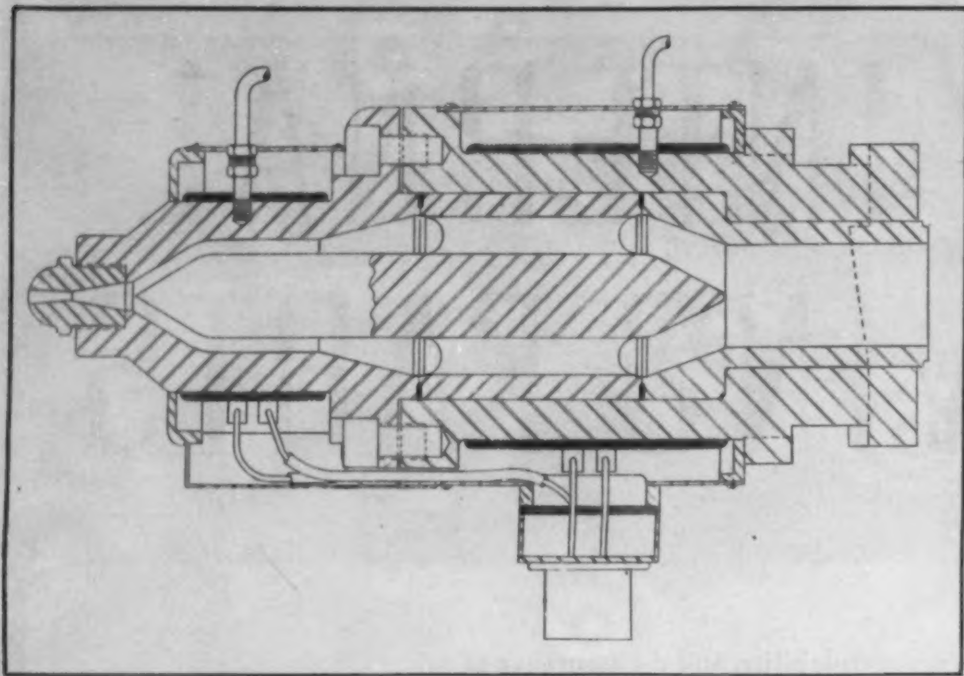
The main operating valves are actuated by solenoids, and a single multi-flex timer is provided for controlling the clamping and injection motions. If it is so desired, all motions may be operated manually by simply energizing the solenoids through manually operated push buttons. The operator must start each cycle by moving the clamp operating lever.

A gravity-type material feed, which is hydraulically controlled, automatically controls the amount of material fed into the feed chamber. This insures the continuous uniform flow of molding material and thus makes possible more rapid cycling without the danger of overheating or burning. The forward motion of the injection plunger measures the amount of material to be fed into the heating chamber; the return movement pushes material into the feed chute. The material then drops by gravity into the feed chamber. The feed-chute opening is large enough to permit positive feed of fine and bulky materials, sprues and runners. A hinged door is also provided for feeding sprues and gates directly to the feed chamber.

The heating chamber consists of front and rear housings and a removable plunger bushing. These bushings can be furnished with various bore diameters to accommodate plungers of different diameters. While the torpedo, or spreader, is clamped in position by the front chamber housing, it can be taken off without removing the chamber from machine. Nozzle tips, available with orifices of various sizes, can be quickly interchanged.

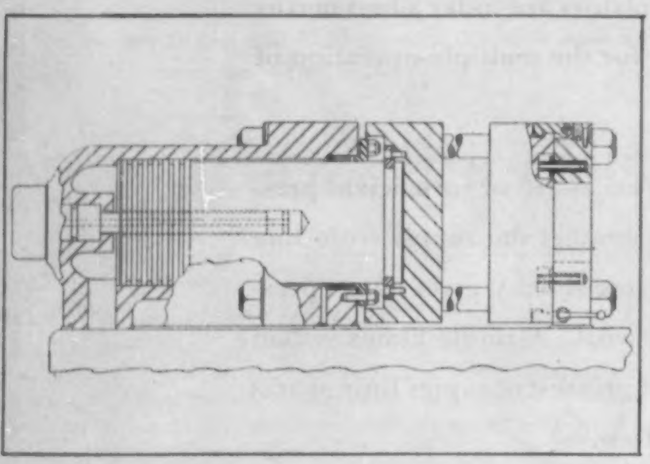
The heating chamber is designed with two positive heating zones which are separated by an insulating air gap which makes it possible for a differential of as high as 100° F. to be maintained between the two heating zones. By maintaining a higher tem-

2

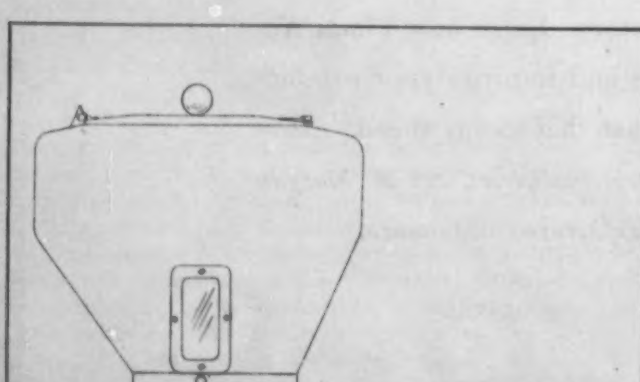


2—Sectional drawing of the new heating chamber used to plasticize material prior to injection. 3—Design details of the straight-line hydraulic mold clamp unit which seals mold halves during injection. 4—Gravity-type feed which automatically feeds measured quantities of material from hopper into the feed chamber

3



4



perature at the rear of the chamber, the cooling time after the material has been injected into the die, can be reduced. This permits a faster over-all machine cycle.

Since the torpedo is also heated, the molding material is actually heated from the inside as well as from the outside. The direct result of this two-way heating feature is faster plasticization. Suitable disconnecting plugs are provided for thermocouples and for the easily replaceable heating bands. Two Wheelco indicating temperature controls are provided—one for each heating zone.

The injection machine is a self-contained molding unit with pressure pumps and controls built in as integral parts of each machine. Two radial pumps, directly connected through flexible couplings to a double end shaft electric motor, provide power for the operation of the machine. One pump powers the hydraulic mold-clamp unit while the other motivates the hydraulic injection unit. The pump control which regulates volume and pressure is mounted directly to the radial pump. A convenient hand wheel pressure adjustment is provided.

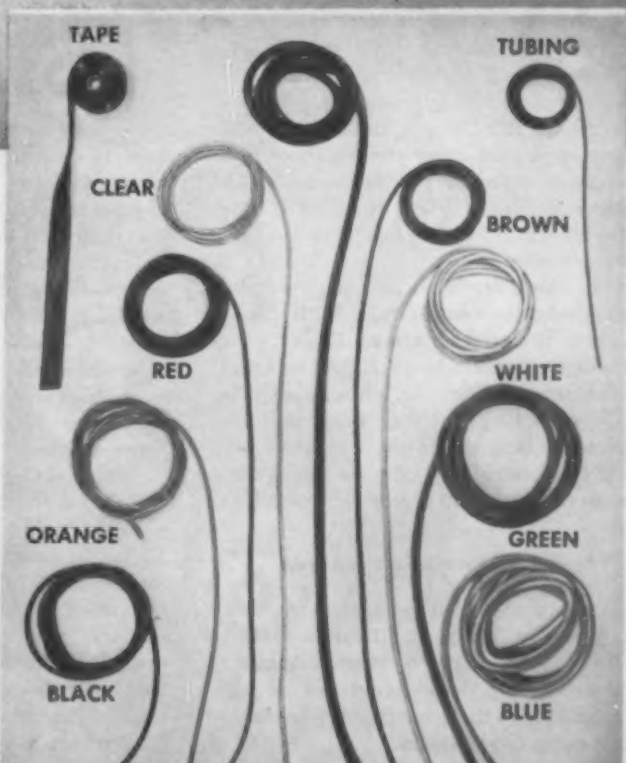
Size and capacity data

Material injected per cycle, oz. maximum	16
Plasticizing capacity per hour, lb.	100
Hopper capacity, lb.	100
Mold clamp capacity, tons	350
Pressure for separating molds, tons	22
Mold space, horizontal × vertical, in.	20 × 30
Clearance between tie rods, horizontal × vertical, in.	$20\frac{1}{2} \times 19\frac{1}{2}$
*Daylight opening, maximum, in.	32
Mold thickness, minimum, in.	12
Clamp travel, maximum, in.	20
Injection pressure on material, lbs./sq. in.	20,000
Injection plunger, diameter, in.	$3\frac{3}{8}$
Injection plunger stroke, in.	12
Heating chamber, kil. required	$6\frac{1}{2}$
Motor, hp.	30
Hydraulic oil required, gal.	200
Over-all space, L-R × F-B, in.	185 × 50
Over-all height, in.	91

*Opening between die mounting surfaces, open position.

Optional: For increased injection pressures at reduced capacities, the injection unit may be equipped with interchangeable injection plungers and chamber bushings of suitable diameters.

Sandee
FLEXIBLE PLASTIC INSULATION



ONE OF SANDEE'S WAR APPLICATIONS

Army's famed "Handie-Talkie," pictured here, is one of the electronic achievements of our time. An important contribution to its efficiency is Sandee Vinyl Plastic in the form of flexible wire insulation tubing. This material possesses excellent dielectric characteristics and extremely low water absorption—properties which make it of great value to the electrical and related industries. However, it is also recommended for many types of gaskets, due to its high resistance to acids, alkalies, oil, alcohol and grease. You are invited to submit your post-war problems to our competent engineers without obligating yourself in any way.

SALES REPRESENTATIVES IN 19 PRINCIPAL CITIES

Sandee Manufacturing Company

3945 NORTH WESTERN AVENUE · CHICAGO 18, ILLINOIS

EXTRUDED PLASTICS AND SPECIAL TOOLS

WASHINGTON ROUND-UP

R. L. VAN BOSKIRK, Washington Editor

Injection machines allocated

Third quarter allocations of plastic injection molding machines, made under General Scheduling Order M-293 by the Facilities Branch of the Chemicals Bureau, were announced as follows:

- One 4-oz., Metal Specialties Co., Cincinnati, Ohio
- One 4-oz., Wills Plastics & Engineering Co., Cleveland, Ohio
- One 8-oz., National Plastic Products Co., Odemton, Md.
- One 8-oz., Halex Ltd., London
- One 8-oz., Tech-Art Plastics Corp., Long Island City, N. Y.
- One 8-oz., Erie Resistor Corp., Erie, Pa.
- One 8-oz., Gits Molding Corp., Chicago, Ill.
- One 12-oz., Continental Can Co. (Reynolds Molded Plastics Div.), Cambridge, Ohio
- One 12-oz., Chicago Die Mold Mfg. Co., Chicago, Ill.
- One 16-oz., Vulcanized Rubber Co., New York City

There was some eyebrow lifting when the allocation was announced because one or two comparatively unknown companies were listed as recipients, and one machine was listed for export to England. Ever since the Chicago meeting last fall, there have been many rumors about new machines exported to foreign countries. There is no evidence to support the charges except for those machines which go for lend-lease.

For those machines allocated to comparatively new companies, a WPB official reports that if the Armed Forces want flashlights, razor boxes, etc., and find that established molders are refusing to take the order, they will then insist that the machines be given to those molders who will produce the job even though it may mean the setting up of a new organization.

Polyfiber restrictions removed

Due to increased production facilities and improved imports, allocation controls were removed from Polyfiber on August 8 in accordance with provisions of the Order M-300, the general order for chemicals and allied products.

Increased production facilities turning out relatively greater supplies of Polyfiber, a chemical product used for vital electrical applications required by the military, have made possible the removal of direct allocation controls of the material. Production of the material is now indirectly controlled through the allocation of its raw materials, polystyrene and dichlorostyrene.

Styrene and butadiene allocations

On Aug. 25, the WPB removed allocation controls from civilian production of styrene and butadiene, important raw materials in the production of synthetic rubber because, WPB said, they are now in sufficient supply as the result of improved production techniques. The allocation control was lifted by revoking Order M-178 (butadiene) and by an Amendment to Schedule 18 (styrene and dichlorostyrene) of Order M-300, the General Chemicals Order.

Styrene is also used in plastics, magnesium castings, aircraft laminates, textile treating, shoe adhesives and electrical insulation. Production of butadiene and styrene in Government financed and operated plants has never been subject to allocation so long as it flowed to synthetic rubber. Because the Government controls 91 percent of styrene production and channels it all to synthetic rubber, no one need look forward to any change in the polystyrene situation according to Government spokesmen.

Production of plastic closures falls off

The current situation in phenolic closures is creating considerable comment. Allocations of phenolic for food and drug closures have indicated a strong decline from 1,491,000 lb. in April to 729,000 lb. in July. From 10,000 to 40,000 lb. per month of off-grade phenolic has been allocated for wine and liquor closures. In addition, 59,000 lb. of cast resins were allocated in the second quarter for cosmetic closures. Urea has been allocated 100 percent for closures, but figures have not been published.

Since molders have been allocated all the phenolic they requested from which to make food and drug closures, this decline in requests probably means that closures are being made in ever-increasing quantities of competitive material.

Black plate rejects were allowed for closures several months ago and aluminum has lately been added. Black plate is cheaper than phenolic, and it is presumed that it has taken a good share of the business. Since production of glass containers has been increased during this period, there has been no lack in demand for closures. Constant pressure has been applied on the Plastics Branch to grant more phenolic for wine, liquor and cosmetic caps.

In the first place, it should be noted that phenolic resin for cosmetics caps has been generally allowed under the Food and Drug Classification. The Plastics Branch gave notice many months ago that it could not distinguish between drugs and cosmetics in many cases. The reason why phenolic cannot be diverted from food and drug caps to wine and liquor caps is largely a matter of benzol. Benzol is still the bottleneck for phenol and the Armed Forces are still demanding every ounce of benzol that they can get for high-octane gasoline. Government authorities will allow benzol in required amounts for products of high essentiality, and there are no denials for phenolic resin for important end uses.

Acetate allocations in decline

Examination of the acetate and butyrate allocations for the past 3 months reveals a steady decline in amount of molding powder allocated for civilian items. From a high of around 5,700,000 lb. in May, the total has shrunk to 4,327,000 lb. in August. It is believed that September allocations will decline even more. On top of this situation there is delivery delay with reports that some companies are as much as 6 weeks behind.

There are several reasons for this situation. First, military demands have shown unusual increases especially in such items as razor boxes, flashlights and steering wheels for trucks. Flake, from which molding powder is made, is also short because of its use in military and lend-lease items. The second is the plasticizer situation. Ever since phthalates became short, most companies have had troubles with substitute plasticizers which have created manufacturing problems and resulted in slower production.

Most of the cuts have been made in buttons, cosmetic packages and "miscellaneous," which includes items of such essentiality as combs, brush backs, household ware, etc. In many cases, only 10 percent of requested amounts were allocated for these items. This situation in acetates may continue indefinitely or at least until more manpower is available and more phthalate plasticizer can be produced—probably by the end of this year.

A new method for announcing allocations was introduced in the August report. Acetates were announced in two classes only. After all military demands have been met, WPB brackets all civilian allocations in Class I and Class II. The first item contains products of highest essentiality, and Class II contains all the remaining products.

NEWS OF THE INDUSTRY

★ DR. WILFRED GALLAY HAS RESIGNED his position in charge of the Section of Colloids and Plastics, Div. of Chemistry, National Research Council of Canada, Ottawa, Ontario, to become a consultant. His present address is 422 Besserer St., Ottawa, Canada.

★ THE FOLLOWING CHANGES IN personnel have been announced by Dow Chemical Co., Midland, Mich. At Midland, C. F. Cummins will have charge of plastics engineering activities in molding powders; R. J. Minbiole will handle packaging materials; P. W. Simmons, protective coating materials; and F. J. Gunn, plastic raw materials. In New York, F. L. Brown will have charge of plastics engineering activities for the Eastern territory and Gage Olcott will assume engineering duties. E. R. Haines will replace F. L. Brown in Cleveland, J. E. Russell will aid C. R. Webster in the Chicago office, and E. E. Chamberlin will replace E. R. Haines in the St. Louis office.

★ RAYMOND H. DAWSON, VICE-president and general superintendent of Elmer E. Mills Corp., died August 13. Mr. Dawson was a member of the Plastics Pioneers and had been connected with the plastics field for more than 25 years.

★ BATTELLE INSTITUTE, COLUMBUS, Ohio, announces the appointment of John E. McMillan to the technical staff where he will be engaged in research in the field of organic chemistry. Mr. McMillan was formerly with Packard Motor Car Co.

DIRECTORY LISTING FOR 1945 PLASTICS CATALOG

If any of our readers have entered the plastics field in any way during the past year and wish to be listed in the Directory of the Plastics Industry of the 1945 PLASTICS CATALOG, we urge them to request a Directory listing blank immediately as all returns must be complete by October 25.

There is no cost or obligation involved. Address Plastics Catalogue Corp., 122 E. 42nd St., New York 17, N. Y.

Listings include: educational institutions; materials and chemicals; material manufacturers; equipment and supplies; machinery; mold and model makers; molders, fabricators, laminators, extruders; consultants; consulting and testing laboratories; industrial designers; molders' markings and trade names.

★ HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio, announces the opening of three branch offices. In New York, serving the territory of New England, eastern New York, New Jersey, eastern Pennsylvania, Delaware, Maryland, District of Columbia and Virginia, the address will be 500 Fifth Ave. D. L. Cleveland will assume the position of branch manager and Mills N. Ripley that of sales manager for this section. Headquarters in Cleveland will be at 717-9 Hanna Bldg. and will serve northeastern Ohio, western New York and western Pennsylvania. C. R. Terry will be sales manager, and Paul E. Flowers, branch office manager.

★ PRO-PHY-LAC-TIC BRUSH CO., Florence, Mass., announces the appointment of Dr. G. F. D'Alelio as vice-president. Dr. D'Alelio will continue in his capacity of director of research.

★ THE AMERICAN SECTION OF the Society of Chemical Industry, Brooklyn, N. Y., has selected Col. Bradley Dewey as the recipient of the Chemical Industry Medal for 1944. The award is being made to Col. Dewey for his work in colloid chemistry, especially as it pertained to rubber latex, and for his accomplishment in administering the synthetic rubber program.

★ HERCULES POWDER CO., WILMINGTON, Del., has made available for exhibition an all-color sound movie telling the story of the cellulose family. It is entitled "Careers for Cellulose," and prints are available, without cost, for exhibition purposes.

★ CRESCENT PANEL CO., LOUISVILLE, Ky., which handles marketing of Kimpreg plastic-surfaced plywood products, announces the opening of the following sales offices: Empire State Bldg., New York 1, N. Y.; 134 S. LaSalle St., Chicago 3, Ill.; 3045 19th St., San Francisco 10, Calif.; 922 So. Fowler St., Los Angeles 7, Calif.; and 3115 No. 20th St., Tacoma 7, Wash.

★ COMPRESSION MOLDING CO. has moved from 2221 South Vandeventer to 3304-14 Morganford Road, St. Louis, Missouri.

★ W. A. JOSLYN HAS ANNOUNCED the appointment of Maurice L. Macht to the technical service group of the Plastics Dept., E. I. du Pont de Nemours and Co., Inc., Arlington, N. J.

★ ALMON G. HOVEY HAS BEEN appointed executive in charge of the new chemicals development section of General Mills Research Laboratories.

★ CARBIDE AND CARBON CHEMICALS Corp., New York, N. Y., has announced that it is now producing allyl alcohol in commercial quantities. Substantial amounts will be available for new users and for expanded consumption by those already using the chemical.

★ ANNOUNCEMENT IS MADE OF the affiliation of H. H. Bashore with Precision Scientific Co., Chicago, Ill., as head of the Rubber and Plastics Div., Technical Sales and Service Department.

★ MOORE MACHINERY CO., LOS Angeles, Calif., has been appointed exclusive representative in the Los Angeles territory for the complete line of Reed-Prentice high pressure die casting machines and Reed-Prentice plastic injection molding machines.

★ U. S. MENGEL PLYWOODS, INC., Louisville, Ky., announces the opening of the second of a chain of plywood distributing warehouses. The new warehouse will be located in Jacksonville, Fla.

★ TIMKEN ROLLER BEARING CO., Canton, Ohio, has appointed R. G. Wingerter assistant chief engineer for the Industrial Division.

★ SEYMOUR ULLMAN HAS LEFT Consolidated Molded Products Corp. and is now taking charge of the New York office and sales for Kuhn and Jacobs Molding and Tool Co., Trenton, N. J.

★ CLARK B. KINGERY, ASSISTANT manager of the Hercules Powder Co.'s chemical plant at Parlin, N. J., has been named manager of the Cellulose Products Dept. plant at Hopewell, Va.

★ MACHINERY SALES CO., LOS Angeles and San Francisco, Calif., will represent Chemaco Corp., Berkeley Heights, N. J., in California, Arizona and Nevada, in the sale of the company's thermoplastic molding materials.

★ JACK FAIRCHILD FLEMING HAS been appointed head of the new Chicago branch of Dohner & Lippincott, New York industrial design firm. This branch office, with departments in product engineering, marketing and packaging, will open about October 1st, with offices in the Carbide and Carbon Building.

★ THE METROPOLITAN DISTRICT office of Northern Industrial Chemial Co., formerly at 11 W. 42nd St., New York City, has been moved to 1180 Raymond Blvd., Newark, N. J.

What is *Good design* in Molded Plastics?

Here's How a CMPC Development Engineer Can Serve You . . . NOW

- By analyzing your products to determine what parts, if any, can be advantageously molded of plastics.
- By helping you in the selection of the best material or materials for your job.
- By putting at your disposal practical experience with the latest war-time developments in plastic molding materials and methods.
- By furnishing preliminary cost estimates to help you in choosing the most economical production methods.
- By suggesting design for most effective and economical utilization of plastics.
- By making laboratory tests to determine suitability of materials for special applications.
- By building experimental molds for sampling and tests.

GOOD DESIGN in molded plastics is design that utilizes the characteristics and properties of plastic materials to the best advantage. Naturally, that requires an intimate knowledge of materials, methods, and techniques.

An excellent example of what we mean is the hinged cover and bezel of the "Megger" Insulation Tester (shown above) molded by CMPC for James G. Biddle Company of Philadelphia. Instead of resorting to drilling and inserting hinge pins, CMPC designers and engineers found a better way. Bezel and hinged lid are produced in only two parts without the use of metal. The flexible bezel (molded of cellulose acetate butyrate) can be bent slightly for easy assembly. When attached to the case it is held rigid forming a substantial hinge.

Simple, isn't it? No magic . . . no hocus-pocus. Just good common sense coupled with the "know-how" that comes only with practical experience in plastic molding.

If you are planning a molded plastic part, why not call in a CMPC Development Engineer who can apply this "know-how" to your own problems? His knowledge and experience as well as that of our entire organization are at your disposal, together with the resources of the largest, best equipped custom molding plant in the Middle West. Write us today. Your request incurs no obligation.

CHICAGO MOLDED PRODUCTS CORPORATION

COMPRESSION, INJECTION, AND TRANSFER MOLDING OF ALL PLASTIC MATERIALS

1046 North Kolmar · Chicago 51, Illinois

Powering a turret

(*Continued from page 127*) would tend to crush the insulation and short the wires. After considerable experimentation, a decision was made to insulate the wires with asbestos but to protect and hold them in place with a glass fiber wrapping. This method of insulation has proved most satisfactory.

Molding the stator

With the exception of one small brass insert, the stator of this slip ring and brush assembly is an all-plastic part. Two gates are used in transfer molding this piece for which a split mold with two side pulls is employed. Six pins—each of which molds a $^1/_4$ in. hole—are assembled on each side pull or bar. The semi-automatic set-up used in this molding operation is shown in Fig. 8. The transfer pot is mounted on a separate bolster plate which can be seen in center of picture, with the transfer plunger suspended from the head of the press. The split mold is shown in position in the chase, with the knock-out pin holding the mold elevated.

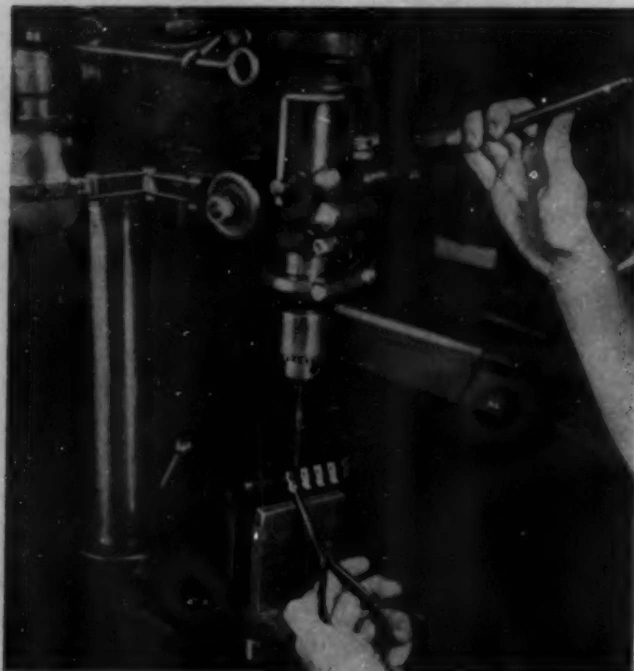
At the beginning of each molding cycle, as the hydraulic ram which supports the chase and split mold is raised, the mold sinks into the chase until it is completely surrounded and supported by it. The entire unit continues to move upward until it engages with the bolster plate which is assembled with the transfer pot. The upward motion of the unit continues until the transfer plunger enters the pot and creates the necessary pressure against the material in the pot to transfer it through the two sprue holes into the cavity. Figure 9 shows the complete set-up just after the mold has been opened. The mold has been partially raised from the chase, and the cull and sprues can be seen still engaged with the transfer plunger. In the next operation the mold is removed from the chase by hand and placed on the work bench where the two side pulls are withdrawn (Fig. 10). These side pulls are not completely removed but are pulled out just enough to disengage the molded part. The split mold is then separated by hand (Fig. 11) to permit removal of the molded stator.

Finishing and assembly

Very little machining is necessary on either the rotor or the stator. While the removal of flash is about the only operation needed to complete the rotor, some drilling as well as a terminal assembly operation is necessary on the stator. Figure 12 shows the terminals being assembled to the stator by drive screws which are driven home by a punch mounted in a drill press. The stator leads are then connected and

ALL PHOTOS, COURTESY PLASTIC MANUFACTURERS, INC.

12



13

***12**—The terminals are assembled to the stator by drive screws which are driven home by a punch mounted in a drill press. **13**—After the brushes, brush springs and leads are put in place, the bottom cover plate is affixed to the unit. **14**—The brushes are held back by a metal tube to permit ready insertion of the rotor in the stator*

14

after all the brushes, the brush springs and the leads have been put in place, the bottom cover plate is affixed to the unit (Fig. 13). A cylindrical fiber cover is then slipped over the body of the stator to serve as a protection for the brushes.

To enable the rotor to be slipped into the open core of the stator, the stator brushes must be spread apart. This is accomplished by the insertion of a metal tube through the center opening of the stator. The inside diameter of this tube is of a size to permit the rotor to be slipped within it (Fig. 14). With the rotor in exact position, the metal tube is withdrawn. This action removes the barrier between the stator and rotor and allows the brushes to contact their proper slip ring.

While these operations complete the assembly of two rather complicated molding jobs, the possibility exists that some short or open circuit has developed during one of the molding or assembly operations. To guard against this eventuality, each unit is carefully checked with test lights. During this operation, cellophane numerals are put on the leads to designate the circuits. This lettering facilitates proper hook-up of the circuits when the assembly is installed in a torpedo plane.

Credit—Material: Bakelite. Molded by Plastic Manufacturers, Inc.

Aladdin's lamp

(*Continued from page 115*) by screwing to it a porcelain ring which when tight rests on the molding itself. Since the chain-socket has been obtained from the supplier with the electrical connections already attached, it remains only to drop the bead chain through a small molded slot in the base and attach to it an acetate ball by adding a bell shaped link to the chain.

Since the base has a place for an electric razor attachment it is necessary to provide the required wiring. Two clipped wires are set in a molded recess and covered with a laminated insulator plate which an automatic screw driver fastens to the base. The base has now reached the center of the assembly line.

Meanwhile, on the left end of the line the shade has started. The first operation is the insertion of a glass bull's-eye lens, which is set in a hollowed recess and the shade placed over it, the undercut lip of the lens going completely through the shade. A slit ring is then snapped into place under the lip so that it secures the lens and prevents it from slipping.

At this stage the shade is ready for assembly with the base, which is placed in a jig and the shade fitted to it. The lugs on the bottom of the shade fit snugly into the molded slots in the base, and further to aid the interlock fit a spring clip is placed around the porcelain retaining ring, the feet of the clip pushing against the shade to hold it in place. A wall bracket and accompanying screws are placed in a paper bag which goes into the individual box in which each lamp is packed to avoid breakage in shipment.

The accessory parts must all be inspected before they are assembled to make sure that there will be no defects in the unit. For example, if the lens is too large it will not fit into the molded hole. If the slit ring is too large it can't secure the lens, and if too small it will spring out of place. If the porcelain retainer ring is too large it won't hold the socket, and the socket will wobble if it's too small. Moldings are also subject to inspection both before and after assembly. Parts that are defective in appearance are rejected before assembly, and those broken or damaged on the assembly line are removed at the final inspection. It is important that all

PHOTO, COURTESY AMERICAN CYANAMID CO. 4

4—As a final operation the light lens is inserted in the assembled fixture. The completed lamp, which is designed to produce maximum illumination without glare, works on the principle of diffused and spot lighting

moldings be passed before an electric light to make sure that the interior surface of the plastic is passable.

The lamp, which is designed to give the maximum illumination without glare, works on the principle of diffused and spot lighting. Some portion of the light is transmitted through the plastic and some reflected upward, the bull's-eye lens serving to direct it to one spot. The lamp throws no shadows in the mirror when placed directly over it. The new fixture meets Underwriters Specifications.

Credits—Material: Beetle. Lens-Lite molded by Universal Plastics Corp. for Lightolier Corp.

Environmental conditions

(*Continued from page 152*)

[11] "Tentative Specifications for Cellulose Nitrate (Pyroxylin) Plastic Sheets, Rods and Tubes," A.S.T.M. Designation D 701 – 44 T, A.S.T.M. Standards (1944).

[12] U. S. Army Specification 94-12008B, "Plastic Sheet, Cellulose Nitrate Base," Materiel Div., U.S.A.A.F., Wright Field, Dayton, Ohio (Dec. 28, 1940).

[13] Federal Specification GG-T-671, "Triangles, Pyroxylin," Washington (Sept. 4, 1934).

[14] "Tentative Method of Test for Tensile Properties of Plastics," A.S.T.M. Designation D 638 – 44 T. A.S.T.M. Standards (1944).

[15] Federal Specification L-P-406a, "Plastics, Organic: General Specifications, Test Methods" (Jan. 24, 1944).

[16] "Determination of Moisture in Native and Processed Cellulose," by J. Mitchell, Jr., Ind. Eng. Chem., Analytical Edition *12*, 390–91 (1940).

[17] "Tentative Method of Test for Compressive Strength of Plastics," A.S.T.M. Designation D 695 – 42 T, A.S.T.M. Standards Part III, 1268–75 (1942).

[18] "Tentative Method of Test for Flexural Strength of Electrical Insulating Materials," A.S.T.M. Designation D 650 – 42 T, A.S.T.M. Standards Part III, 1068–70 (1942).

[19] "Tentative Methods of Test for Impact Resistance of Plastics and Electrical Insulating Materials," A.S.T.M. Designation D 256 – 43 T, A.S.T.M. Standards Supplement, 249–54 (1943).

Molding markings

(*Continued from page 142*) sharp on the one-piece metal ring. This accomplished, the holding-down screws were released, tapered plug withdrawn, and the wedge blocks and die retracted. With the raised letters in the ring thus disengaged from the depressed engraving, the hardened steel die was removed.

Twelve times this operation was performed with a different die being installed for each position. There remained but the job of plugging and hydrogen-brazing each one of the 12 holes, boring out the section of the ring marked B, polishing the engraving and the inside of the ring, and truing up the outside diameter. The unit then was ready for assembly in the mold.

Credits — Material: Durez. Original design by American Aircraft Assoc. Engineered and molded by The Plastic Moldings Corp. for McCaskey Register Co.

Transfer mold

(*Continued from page 135*) up for use in this floating platen. The molds used in the press are designed for use with one of these stock transfer chambers. Presses of this type may serve as conventional compression presses, and the floating platen may also be used for the stripper plate operation in a compression type stripper plate mold. This excellent system eliminates the necessity for the construction of a transfer chamber and plunger as an integral part of each mold.

Noteworthy also in Fig. 4 is the use of sliding mold plungers and the fixtures provided to facilitate loading of the inserts. During the curing period one of the extra mold plungers is loaded in the fixture on one side of the press. When the press is opened up (Fig. 4) after the cure, the plunger containing the newly molded piece is pulled into the other heated fixture for part removal and insert loading.

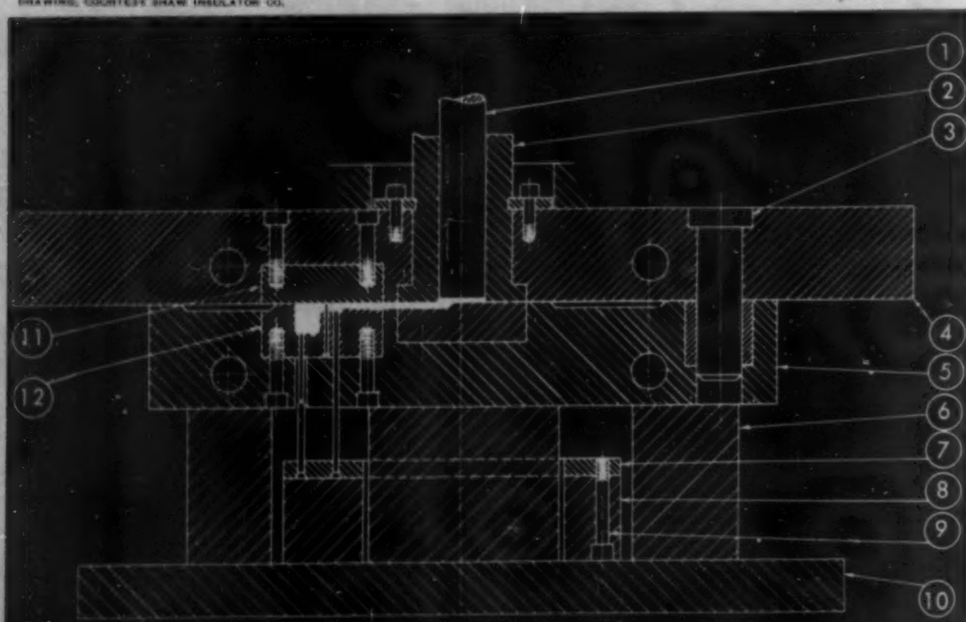
The mold design type shown in Fig. 5 is very widely used for transfer molding. Molds of this type are built as an integral unit, each mold having its own transfer chamber and plunger. This results in a gain in efficiency for many molds since the transfer chamber may be designed for best results with the cavity shapes required. Molds of this type are constructed for hand or for semi-automatic operation. The transfer chamber may be located above or below the mold cavity and the material may flow through a sprue, runner and gate or it may gate directly into the piece.

Transfer molding is also done in many shops by the use of molds that are similar to the "pressure type" of die casting die. This system is also called "duplex molding." A typical mold of this type is shown in Fig. 6. This variety of mold, combined with high frequency or other improved types of preheating equipment, will give highest quality molded parts, maximum production per cavity and per dollar of equipment investment. Sprues are eliminated and the size of the cull reduced to a minimum. This mold will generally cost less than the integral type of transfer mold.

In operation, this mold type makes use of the conventional hydraulic press for clamping pressure only. The transfer pressure is provided by an auxiliary ram or by means of a small ram within the main ram. This transfer ram may operate from above or from below the mold. Many molds of this type have the ram enter the side of the mold at the parting line with half the transfer chamber in each mold half.

Note: The second article of this series will deal with transfer mold design considerations including pressures, heating areas, gate location, sprue pullers, runners and gate design, venting, number of transfer chambers per mold, etc.—ED.

DRAWING, COURTESY SHAW INSULATOR CO.

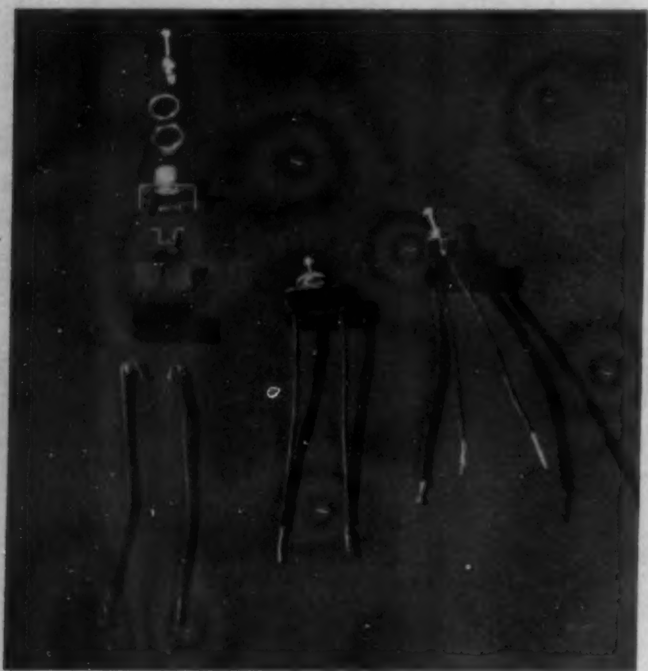


1	PLUNGER	7	PIN PLATE
2	LOADING CHAMBER	8	KNOCK-OUT BAR
3	GUIDE PIN	9	PIN PLATE SCREW
4	FORCE PLATE	10	BOTTOM PLATE
5	CAVITY PLATE	11	FORCE
6	PARALLEL	12	CAVITY

6—*Design of a pressure type of transfer mold which makes use of the conventional press for clamping pressure only. Transfer is effected by means of an auxiliary ram*

Lamp guards

(*Continued from page 131*) changes made in the switch itself were similar in every respect to those previously described, the approach to the housing problem was entirely different. Figure 3 (right) shows a completely assembled unit as well as the two halves of the switch housing, and the switch itself. Close observation reveals that the two halves of the switch housing are exactly symmetrical. Therefore, the difficulties inherent in having top and bottom halves of an assembled unit are completely eliminated. The two prongs projecting from each half of the housing have molded undercuts, while the slots on the outside of these housings have rather sharply defined steps molded in half-way up the height of the wall. In order to assemble the unit, the switch is nested in one half of the housing, the prongs on this half lined up with the slots on the opposing half and the unit snapped together—the undercuts on the prongs engaging with the steps in the slots to make it a permanent assembly. This patented design has made it very simple for the company to furnish its various types of switches either completely insulated with phenolic housing or stripped according to the requirements of its customers.



5—Two completely assembled switches and the plastic housing which is a component part of each switch

Another unique departure from the usual design of phenolic parts for electrical apparatus involves actual knock-outs in the side wall of the housing. The present design permits lead wires to enter the housing at four different points. It is only necessary to remove the thin, or knock-out wall from the side of the housing where the feed wire is to enter. This idea enabled the company to use the one standard housing for many differently constructed switches.

Of course, all types have the same "double-deck" feature and are of the same general over-all dimensions. The real problem was in developing a housing for their many types of fan switches—many of which had differently arranged terminals. This job was started with a single-cavity mold. Finally, the company built a 4-cavity mold to meet the increased demands. While it is true that the undercuts on the projecting lugs are stripped from the force plugs in the molding operation and are designed to snap into place in order to engage the two halves securely, it is not to be assumed that the switch housings are made to be assembled and disassembled any great number of times. The snap feature is meant for practically permanent assembly and nothing else. Figure 5 shows two other completely assembled switches and the plastic housing which is a component part of each. This small housing, 1 in. in over-all length, is used for one- and two-circuit tumble switches, with a rating of 6 amp. at 125 volts. This 6 amp. 125 volt rating for such a small switch indicates the care and ingenuity that went into its design. Two 8-cavity molds have been constructed for this small tumble switch housing, and each mold has two sets of force plugs to allow for switch plugs having round openings for wire leads and narrow slots for solderlugs or terminals.

Credits—Material: Insurox and Bakelite. Lamp No. 3007 molded by General Electric Co. Fan Switch housing molded by Stewart R. Brown, Inc. All other lamp and switch parts molded by Richardson Co. for McGill Mfg. Co., Inc.

Compound shapes

(**Continued from page 139**) have some test data as an indication of the characteristics of this material. Table I should only be considered as an indication and not a true measure of the comparative strength characteristics of this material molded into irregular shapes. The values in this table might best be considered as minimum values. The true strength qualities of the piece to be molded can only be determined by molding it from X-crepe and then making identical comparative tests on the same piece molded from other molding materials.

Illustrative applications

Some examples of specific moldings may be of assistance in proper visualization of the use of the X-creped materials. Figures 6 and 7 show two pieces containing inserts and the charges used in producing them. These inserts are securely held by reason of the filler laminations moving into the scoring at the base of the insert.

Figure 13 illustrates a part molded from die-cut forms. This molding was compressed from blanks such as those shown in the photograph. The smaller blank is used at the base in order to build up the wall section in that area which is considerably heavier than that at the upper end of the casting. The developed blanks are weighed and distributed on either side of the core, whereupon the mold is closed. The bosses located at the inside of the base and the raised detail along the outside of the piece are filled out by flow of the material.

Figure 12 shows a piece molded from a charge of rectangular sheets. It can be seen that the flow requirements on this piece are extreme, yet the kraft material has moved in to fill the detail perfectly—producing a continuously laminated structure.

Coil charge preforms are illustrated in Figs. 8, 9, 10 and 11. The casting shown in Fig. 11 has been cut to expose the cross-section. The threaded area into which a key way was molded, was formed from a wider coil placed within the large-diameter narrow-width coil.

The complicated casting shown in Fig. 10 is an excellent illustration of what can be done with X-creped cloth. An examination of this piece will disclose molded holes, inserts, varying wall thicknesses, bosses, molded threads and under-

Not a Lemon in a Blue Moon

A very good reason exists why you'll have a hard time finding a mounted point or wheel with hard and soft spots among those bearing the Bay State *blue flash* trademark.

Bay State manufactures mounted points and wheels in *blank* form then shapes, trues and sizes them after mounting on the mandrel. The finished product is sharp, smooth-running the instant you touch it to the work—no wasteful "breaking-in" period required.

In a broad range of abrasive products, Bay State offers extra advantages... the finest honing and superfinishing stones ever manufactured... portable snagging wheels with extra safety features... precision grinding wheels in fractional grades...etc. Plus engineering assistance to help you get the most from grinding.

Do you have the handy, pocket-sized catalog of Bay State Mounted Wheels and Points? If not, send right away, for Catalog D.

BAY STATE ABRASIVE PRODUCTS CO.
WESTBORO, MASS.

BLUE FLASH GRINDING WHEELS *FAST and COOL*

HONING AND SUPERFINISHING STONES · CUT-OFF WHEELS · INSERTED-NUT DISCS · AND CYLINDERS · PORTABLE SNAGGING WHEELS · MOUNTED WHEELS · AND POINTS · GRINDING WHEELS

cut sections. The threaded hole at the left was produced by a side core in the mold. Other side-core detail exists on the opposite side of the casting. The coil charge at the right is identical in all respects with the one from which the photographed piece was made.

Although the above illustrations are indicative of some of the unusual shapes which may be produced from these materials, there is no intention to imply that these materials are limited to such shapes, as many other complicated forms have been molded from them.

Credit—Material: Resin X-crepe.

Hub of the home

(*Continued from page 121*) plicity and low cost of the actual molding operations can be added the fact that the glass laminates are easy to machine and can be handled by standard metal machining tools.

For very practical as well as for aesthetic reasons, the excellent properties of plastic-supported glass will rate it high in bathroom and kitchen. No longer will annual painting of the walls or periodical enamel spraying of the fixtures be needed, for the plastic walls and fixtures will retain their original freshness. In addition, its impact resistance, sound-dampening qualities, low thermal conductivity and the fact that it will not support combustion make it ideal for this purpose.

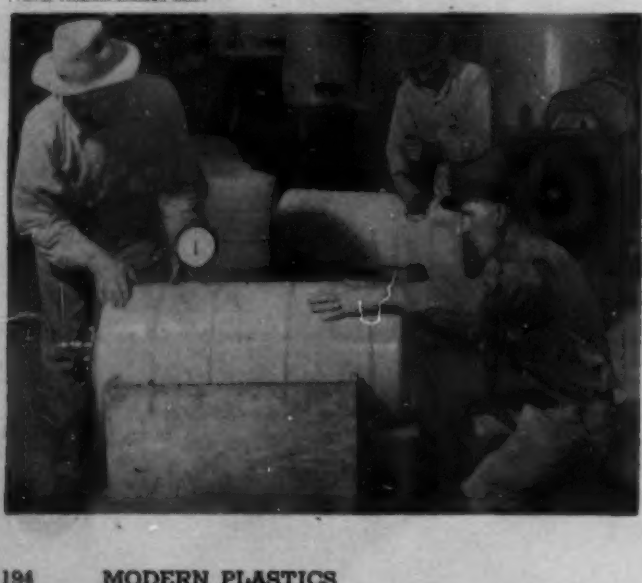
The dimensional stability of the material, of great importance for the types of units planned, is excellent, for the filler is comprised entirely of minute glass rods which are non-absorbent. It is far superior in this respect to the medium and high impact phenolics for, under test, glass laminates will absorb 0.3 to 0.5 percent in 24 hr. while the range for macerated fabric-filled phenolics is 0.5 to 2.5 percent.

Within the low-pressure family, the resin-impregnated fabrics have the highest strength properties, and they are higher than those of any high-pressure moldings.

Before the advent of these war-born materials, the light-weight metals figured in the pipe-smoke dream kitchens and bathrooms of Tomorrow. Low-pressure glass laminates, however, have some distinct advantages. Their strength to weight ratio proved as high, or higher, than that of aluminum alloys now used in the manufacture of aircraft. In addition,

10—*De-icing fluid tanks, made from cloth laminate, being pressure tested in a final operation before their release*

PHOTO, VIRGINIA-LINCOLN CORP.



of major consideration for household units, the scratch and stain resistance put them in a category of their own. Most important of all, however, especially for prefabricated structures, are the large size possible for the individual molded parts, the fact that fewer parts are therefore necessary, and the consequent simplicity of assembly. Even for factory assembly, this figures sharply. Recently the cabin of the new Army R-6 helicopter was redesigned for construction in glass laminate instead of aluminum, for it was found that the number of parts could thus be reduced from 150 to 25. As a result, man-hours were cut in half, the cost reduction was commensurate. It was expected that the high strength-weight factor of the plastic would also produce a lighter assembly but the very high saving in weight, 10 per cent, exceeded expectations.

Credits—Material: Valenite. Postwar designs by Sundberg and Ferar. Molding by Virginia-Lincoln Corp.

Drafting instruments

(*Continued from page 114*) in width, and on the 5-in. instrument there are as many as 1600 lines, with double that number on the 10-in. type. Various calibrations are molded into different models, according to their use. For example, one 5-in. type has scales of A, B, CI, C, D, K, S, L and T, with millimeter and inch scales on the beveled edges.

It is interesting to note that many such slide rules in use before the war came either from Germany or from Japan, the German variety made mostly of wood, and those from Japan mostly of bamboo. Both had glued celluloid faces. In Japan, reports have it, girls working without pay scratch each fine dividing line individually, putting them under terrific eyestrain.

Both wood and bamboo, being natural products over which man can exert little control, are materials which are susceptible to high water absorption, warping, twisting, splintering and all the ills of the natural product. Plastic materials of which these drafting instruments are now made are strictly controlled chemically during the process of their manufacture. Methods of molding employed maintain exacting control during the molding process and provide for normalization after molding which, according to the molder, maintains the uniformity of these plastic products during a lifetime of use.

The company molds two types of plastic protractors, both of polystyrene. One of these is a half round model of the type commonly stamped from transparent plastic sheet. The other, however, has a number of unusual features. It is a full round, 360° cut-out, beveled, 6-in. type with half-degree graduations and numbers, which is molded complete in one operation. The former method of making this protractor was to cut it from sheet stock (which involved considerable waste), then stamp on the numbers, bevel, machine divide and emboss it.

Flat four-bevel scales for architects and engineers, made in the 6-in. pocket size and 12-in. standard size complete the company's line of precision drafting instruments. These scales are molded of acrylic in the same manner as are the triangular scales.

Many of the new drafting instruments have been subjected to hard usage under difficult conditions and have shown unusual ability to stand up and retain their accuracy of graduation and calibration. Recent tests of the all-plastic rules under high humidity have shown them to be unaffected, while the celluloid-faced triangular scales, for example, were

not usable after the same test because the faces loosened from the base wood.

The company maintains its own engraving, tool and die, and molding departments under one roof, and the management reports that most of the equipment is standard, with numerous special variations and attachments to meet the requirements of precision work.

Credits—Materials: Bakelite polystyrene, Lucite, Lustron, Plexiglas, Styron. Instruments molded by Pereles Bros., Inc.

On the surface

(Continued from page 113) depends upon a solvent, no hope can be held for decorating or coating the phenolics in this way. However, the very stability and low water absorption of the phenolics, which prevent their accepting this type of coating, also render them less in need of special decorating materials. Baking enamels and lacquers perfected for glass and metals can be applied and baked at low temperatures to form a satisfactory bond.

During the war, there has in general been little decoration of any product. Most of the activity described above has been in the field of marking packages for civilian use, and in markings, nomenclature and calibrations for war-effort items. Relaxation of restrictions on consumer goods, however, will see it extended into many new fields. One large manufacturer is already planning to decorate a plastic flashlight in this way; another is planning a new plastic playing card. Radio cabinets and many household items, some planned and some not yet thought of as plastic applications, will be decorated in this way. The scales of radio dials, thermometers, perhaps motor car instruments will be similarly marked—permanently, durably, handsomely.

Acrylic for surgery

(Continued from page 111) this growth ruled out further use of the old cap, a new acrylic form was constructed. This work took nearly one week and the skull increased an additional $^1/_2$ in. in circumference. During the following four weeks that this new cap was left undisturbed, the infant's body increased in size, catching up with the head size. Except for periodic checkups, the head cap remained intact for several months.

While the head cap was removed before the child's body grew in proportion to the size of his head, subsequent growth continued in a somewhat normal manner. Although actual studies and measurements could not be continued, the following conclusions may be stated with reference to the use of a simple acrylic plastic cap as a treatment for hydrocephalus:

1. The child's head is not enlarged to a point where it is a source of embarrassment.
2. Abnormal growth of the head has apparently ceased.
3. The child was spared surgery which, in most instances, has not resulted in cure.
4. No apparent harm was done to the child—mentally or physically.
5. It has been indicated that growth of the cranium can be arrested by prosthetic means without subsequent harm and with probable normal or abnormal opening of the communication between the skull and the spinal cavity.

Credits—Material: Plexiglas.

Putting on the brakes

(Continued from page 124) the cylinder of the extrusion machine into which it is placed. The die, at the extruding end of the cylinder, through which the charge is forced, is externally heated to help maintain a certain desired plasticity or softness in the extruded strip. In the case of the particular brake block under discussion, this die has an opening about 4 in. wide and $^7/_8$ in. high.

As the charge is forced out through the die opening in a continuous strip of the dimensions noted above, it is several feet long (Fig. 4). For other types of lining it may be several yards long—depending upon the size of the die used and the number of charges in the cylinder. This strip slides along to a cutter where it is chopped off into the approximate length of the finished brake block. Inasmuch as not enough of these particular blocks are made to necessitate automatic production, the cut-off segments are given a quick manual forming over a shaper form and then passed directly to the pressloading table. Here the segments are loaded into another die and cold pressed to their approximate final dimensions.

In the next step the blocks, which have had time to cool to a semi-rigid state, are loaded into a curing form which is drum-shaped and holds about 8 segments. Held securely in this form under pressure, they pass along a conveyor to a horseshoe-shaped oven where they are cured. This curing process, one of the vital operations in the production of the brake blocks, must be positively controlled—accurate in both the varying degrees of heat applied and the time of each cycle.

A thorough inspection follows the removal of the now hardened blocks from the oven. They are then delivered to the drilling machines and hence to the grinders. Rivet holes are drilled, then countersunk. The edges of the blocks are ground, and the inside radius of each piece established by another grinding operation. More grinding follows until the block is ready for the final inspection. The inside radius must pass a 0.005 tolerance while the thickness is calipered even more closely. With the inspection completed the blocks are ready for shipment (Fig. 2). Packed in sawdust in heavy wooden boxes, they leave the plant for their ultimate destination—the truck manufacturer's assembly line.

A natural question seems to follow. "What has been achieved through this process of manufacture?" The answer is summed up briefly in the statement that "a homogeneity in the material is obtained which, apparently, cannot be achieved in any other way." Just as in the case of a molded plastic part, every section of the finished block is exactly the same. This means several things to the ultimate user—longer life for the lining; uniformity of wear because the lining has exactly the same structure and the same composition from the outside radius to the inside radius; and prevention of drum scoring, a condition that not only adds to the efficiency of the brakes but increases brake-drum life. As a consequence, the per-mile cost of operating vehicles on which these brake blocks are used is considerably lowered. The phenolic resins also have a beneficial effect upon the heat resistance, grease and oil resistance, and non-fade qualities of the blocks—characteristics of considerable importance in brake blocks or linings.

When, in the postwar era, these commercial blocks or linings are built into our passenger cars, they will make an important contribution toward the safety of thousands of car owners and pedestrians.

Credits—Material: Durez resin. Molded by the Molded Materials Div., Pharis Tire and Rubber Co.


SPECIFY
BIRDSBORO PRESSES
TO SOLVE YOUR
PLASTIC PRESS PROBLEMS
Birdsboro Presses for compression molding, transfer molding, and sheet curing offer a range of engineering designs to meet many plastic press requirements. They can be furnished with either straight manual, automatic single cycle or full automatic continuous controls, designed to meet all phases of the required molding cycle. They can be furnished from standardized designs in sizes from 25 tons to 300 tons and basic designs are available for larger sizes.
In answer to your plastic press problems specify Birdsboro Presses.
Birdsboro Steel Foundry & Machine Co. Birdsboro, Pa.
BIRDSBORO
HYDRAULIC PLASTIC PRESSES
BIRDSBORO
HYDRAULIC

War as a proving ground

(*Continued from page 104*) equipment common to ordinary cotton textile operations is employed in the weaving of the vinylidene chloride monofilaments. Because of differences in characteristics of this material as compared to cotton, some adjustments and modifications of the machinery have been necessary. The warp can be prepared on a warp beam or the warp filaments can be brought into the loom directly from the creel (the racks on which the spools of filament used in the warp are placed). This latter method, however, has distinct limitations because of the large amount of space required. In either operation, no sizing of the warp is necessary. For winding the filling on bobbins, a No. 90 Universal Winder has been found to be suitable.

The weaving is done on Draper looms of the type used in the weaving of tobacco cloths. Because of the greater tensions involved in handling vinylidene chloride monofilament in diameters of 0.012 and 0.015 in. as compared with the tensions encountered in handling tobacco cloth yarn, certain modifications have had to be made in some of the loom motions. Another important modification is a special shuttle which was designed by the company producing this plastic cloth.

The screen cloth now being used by the Navy for such applications as the tents shown in Fig. 1 is woven in 20 mesh and in a 29-in. width from olive drab vinylidene chloride monofilament of an approximate diameter of 0.012 inch. Originally, this Navy cloth was woven in 18 mesh from 15-mil. filament, but a change was made to the lighter-weight 20-mesh fabric in order to get more square feet of screen cloth from the amount of this plastic available. While it is estimated that 80 percent of the screen cloth sold for use within the United States is woven in 16 mesh, it has been found that in tropical areas a 20-mesh cloth is required to keep out smaller insects.

The plastic screen cloth now being furnished for the manufacture of inner soles for Army jungle boots is being woven in 16 mesh from natural-colored vinylidene chloride monofilament with an average diameter of 0.015 inch. This insole is made up of five layers of plastic screening to permit a maximum of ventilation and afford sufficient cushion.

Use in the postwar home

Anticipated increased efficiency in the manufacture of this plastic screening and in the production of the raw materials is expected to bring down the price so that the material is within reach of the average home-owner's pocketbook. The firm is planning to market this plastic cloth on a wide scale to meet the postwar building demand and a considerable part of the replacement market which has been held in abeyance during the war.

In developing this screen for domestic use after the war, it is believed that the plastic screening's extreme flexibility, which makes it less liable to permanent damage by accidental blows or puncture, will prove to be a strong asset. This flexibility also opens up possibilities for further development in the roller-type screen industry. Another asset of this material is that its weight is about one-fifth that of metal. This characteristic, added to the material's flexibility, should make for easy handling and mounting by amateurs. The smooth surface of this filament does not collect dirt easily, and any soil that does collect can be quickly washed off with ordinary soap and water.

Because of the material's resistance to corrosion, it will not stain window sills or side walls, and needs no painting—a valuable asset in screens used in homes along the coast. If colored screen is desired, the plastic will be available in a wide assortment of colors after the war. In the natural color, this screen's translucency permits the entrance into the room of light which is lost when conventional screening is used. This is also true, to a lesser extent, of many of the colored filaments. Like most household equipment, the plastic screen can be destroyed by fire, but when it is exposed to flame heat, it merely melts—it will not burn.

Because this plastic is under such strict allocation by the War Production Board, the screens will not be available for the civilian market for some time. However, the company is laying the groundwork for its postwar plans by a recently instituted advertising program covering hardware, building materials, architectural and allied periodicals.

TABLE I.—PHYSICAL PROPERTIES OF LUMITE AND OF THE SARAN MONOFILAMENT FROM WHICH LUMITE SCREEN CLOTH IS WOVEN

Specific gravity	1.68–1.70
Thermal expansion	None
Resistance to heat	Shrinks above 170° F.
Softening point, ° F.	240–280
Water absorption, immersion 24 hr.	Less than 0.1 percent
Burning rate	None
Effect of age	None
Effect of sunlight	None
Effect of acids, alkalies and solvents	None to slight
Color possibilities	Extensive
Clarity	Translucent to opaque
Flexural strength	Excellent
Impact strength	Six times greater than that of conventional screen cloth
Tensile strength, ultimate (of filament), per sq. in.	Up to 50,000 lb.
Filament elongation at yield point, percent	20–30

Credits—Material: Lumite, woven from saran monofilament by Chicopee Mfg. Corp. of Georgia. Extruded by National Plastic Products Co.

The 6 x 42 binocular

(*Continued from page 110*) was checked subsequent to each cycle in order to establish a correlation between dimensional changes and their effect upon optical alignment.

The dimensional changes were measured over linear distances as indicated in Figs. 9 and 10. Changes in dimensions and alignment are shown in Table V. It should be noted that the assembled binocular was subjected to the moderate accelerated service-condition cycles, and changes in optical alignment were measured directly. The high and low temperatures of the extreme accelerated service-condition cycles, however, would have resulted in separation of the optical doublets, and it was necessary to measure the dimensional changes of the disassembled body parts and to calculate the optical deviation from the correlation established in the moderate cycle tests. These extreme temperature and humidity cycles were devised to be equivalent to approxi-

Table III.—Optical Tests on 6 × 42 Binocular[a]			
Property or test	*Left side of binocular*	*Right side of binocular*	*Remarks*
Power	5.97×	5.97×	
True field	8° 32′	8° 33′	
Apparent field	50° 38′	50° 41′	
Effective aperture, mm.	41.8	41.7	Measured full aperture of obj. = 42.0 mm.
Exit pupil, mm.	7.0	6.98	
Eye distance, mm.	14.2	14.0	
Dioptric scale	None	None	
	E.P. Set −0.6 D.	E.P. Set −0.6 D.	Fixed focus
Interpupillary graduations	None	None	(Fixed interpupillary distance of 65.0 mm.)
Collimation, vertical	Zero	Zero	
Collimation, horizontal	1.5 ft. divergent	1.5 ft. divergent	
Squaring	Satisfactory	Satisfactory	
Star test	Fair	Fair	Both barrels have round stars with 4 mil dia. diffusion circle around each. Shows probable spherical aberration
Resolving power (4.75 × aux.), in.	6	6	Both barrels hazy
Contrast rendition	Poor	Poor	Inside white targets appear slightly yellow and fade into grayish-black background
Color	Fairly good	Color fringes noticeable in last 3rd of field	
Distortion	Slight pincushion	Slight pincushion	
Strain	Slight strain not objectionable	None	
Striae and bubbles	One large bubble and vein of striae in prism system	None	
Light transmission, percent	78.8	78.7	Coated glass optics

[a] Tests made by U. S. Naval Gun Factory.

mately 3 yr. of use under average service condition. The resulting variation in optical alignment is approximately one-third of the allowable tolerance for Navy binoculars.

Optical and structural effects of impact—The 6 × 42 plastic binocular was subjected to the same impact test procedure used in the preliminary tests on 7 × 50 plastic binoculars. Test results are indicated on Fig. 11. An unassembled binocular housing was also subjected to impact tests in order to determine the strength of the plastic sections and the rigidity of the optical support members. A 130-gm. steel ball was dropped from a height of 15 in.; then the height was increased to 40 in. in 5-in. increments for each of the nine impact points indicated in Fig. 12. The effects of impact on the molded binocular structure are indicated in Table VI.

Results of the impact tests demonstrate the ability of the binocular to withstand satisfactorily the impact of a 130-gm. steel ball falling from as high as 43 in. before the deviation of the optical axes exceeds the 3-min. tolerance. The standard Navy aluminum binocular will not maintain acceptable alignment upon impact with this steel ball from a height greater than 30 inches. Impact tests on the assembled binocular at a point where a metal insert is located (No. 2 in Fig. 12) resulted in a maximum change in optical alignment of 1 min. of arc upon impact from a height of 44 in. (see curve for point No. 2 on Fig. 11). The visible physical effects of the extreme 40-in. impact on the disassembled binocular body consist only of slight cracks occurring at various points on the housing (Table VI). Since impact of this magnitude simulates extremely severe conditions, the selected plastic material molded in this design is considered satisfactory for Navy use.

Water immersion tests—One pair of 6 × 30 binoculars, one pair of standard 7 × 50 binoculars, two pairs of different types of 7 × 50 watertight binoculars, and one 6 × 42 plastic binocular were subjected to pressure tests in order to determine the watertight integrity of the plastic binocular as compared with present standard Navy instruments. These tests were conducted in the Mine Laboratory Tank and Telescope Pressure Test Tank at the U. S. Navy Yard, Washington, D. C. Test conditions and results are indicated in Table VII.

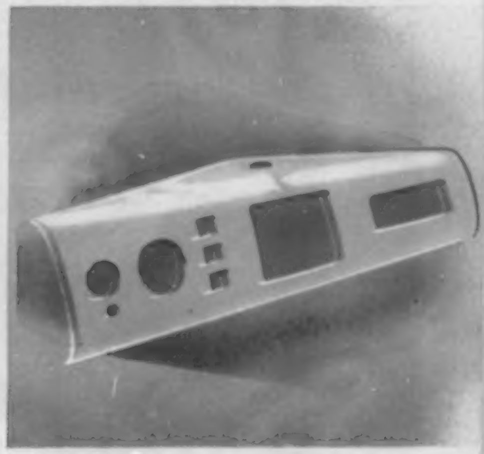
The plastic binocular satisfactorily withstood water pressure of 45 p.s.i., equivalent to immersion in 103.6 ft. of water. The more satisfactory of the two standard Navy 7 × 50 waterproof binoculars subjected to this test withstood a pressure of only 4.3 p.s.i., equivalent to immersion in 10 ft. of water. The standard Navy 7 × 50 and 6 × 30 binoculars were capable of withstanding immersion to a depth of only 1.1 ft. of water.

Fungus exposure—A 6 × 42 plastic and a standard 6 × 30 binocular were subjected to fungus tests at the University of Pennsylvania in order to determine the effect of microscopic organisms indigenous to tropical areas. The instruments were placed in a tropical chamber inoculated with fungus spores from the Panama region. Temperatures in the test chamber varied from 70 to 90° F. with a relative humidity of 70 to 80 percent during the day and 90 percent at night. These temperature and relative humidity cycles approximate meteorological conditions in tropical areas.

The binoculars were subjected to the above conditions for approximately 12 weeks. Slight fungus growth appeared in the right chamber of the 6 × 30 binocular after a 3-week period. After 8 weeks of exposure, extreme fungus growth was apparent in the interior of that instrument, and its optical performance was seriously affected. No evidence of infection was noted either in the interior or on the exterior

Low Cost Plus Physical Properties Make Polystyrene the No. 1 Plastic

Huge war production points to early availability of Styron (Dow Polystyrene) in required peacetime quantities and at an exceptionally attractive price.



The eyes of the Plastics Industry are on Styron (Dow Polystyrene)—and with good reason. For, when war requirements diminish, Styron will immediately be available in sufficient quantities for peacetime needs—much sooner than many other plastic materials. It will be ready when you are. This is due to the fact that huge war needs have resulted in a tremendous expansion of manufacturing facilities . . . production has skyrocketed.

Furthermore, because of its huge production, the price of Styron will definitely be to your liking—it may even surprise you.

And Styron will be popular for peacetime products for the very reasons that carried it to the top during the war—the inherent value of its properties.

The characteristics of Styron are really outstanding . . . it is immune to acids and alkalies . . . it has high dimensional stability even under prolonged heat and severe conditions . . . it possesses a clear transparency and brilliant color appeal.

Because of these advantages, you will want to hear more about Styron. We shall be glad to send complete details.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

DOW PLASTICS INCLUDE

- **STYRON** . . for fabricators producing moldings, extrusions, rod, sheet.
- **ETHOCEL** . . for fabricators producing moldings, extrusions, coatings; available also as Ethocel Sheeting.
- **SARAN** . . . for fabricators producing moldings, extrusions, pipe, tubing, sheet; available also as Saran Film.

STYRON

(DOW POLYSTYRENE)

DOW

CHEMICALS PLASTICS MAGNESIUM

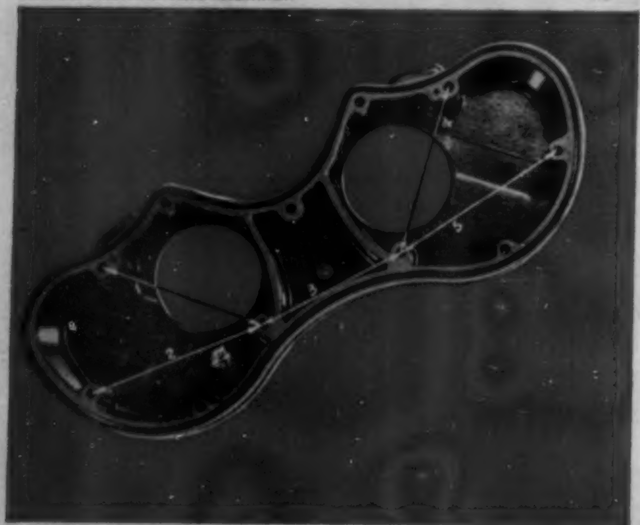
INDISPENSABLE TO INDUSTRY AND VICTORY

of the plastic 6 × 42 binocular at any time during the 12-week test.

Summary

Evaluation tests performed on the 6 × 42 plastic binocular indicate that binoculars manufactured in accordance with this design will satisfactorily fulfill all requirements for a general-purpose service binocular. The instrument was de-

PHOTOS COURTESY U.S. NAVAL OBSERVATORY



9

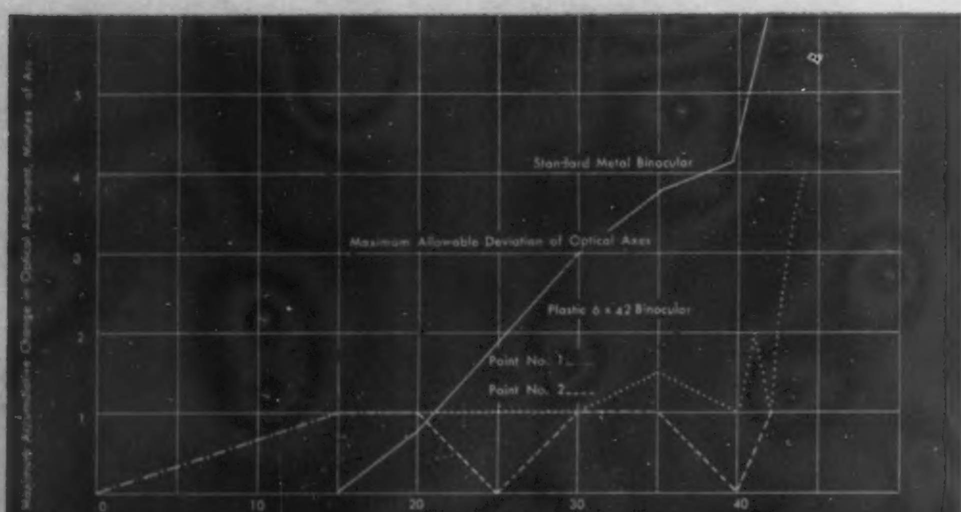
10

TABLE IV.—ACCELERATED SERVICE CONDITION CYCLES USED IN TESTS OF THE 6 × 42 PLASTIC BINOCULAR[a]

Time	*Temperature*	*Relative humidity*
hr.	*° F.*	*percent*
Moderate service condition cycle:		
24	140	95–100
24	−30	95–100
24	140	2–5
24	−30	95–100
Extreme service condition cycles:		
Test cycle A		
24	160	70–75
24	−40	95–100
24	160	2–5
24	−40	95–100
72	77	50
Test cycle B		
24	175	70–75
24	−40	95–100
24	175	2–5
24	−40	95–100
72	77	50
Test cycle C		
24	175	70–75
24	−40	95–100
24	175	2–5
24	175	70–75
24	−40	95–100
24	175	2–5
24	77	50
24	175	70–75
24	−40	95–100
24	175	2–5
96	77	50
24	175	70–75
24	−40	95–100
24	175	2–5
24	175	70–75
24	−40	95–100
24	175	2–5
24	77	50

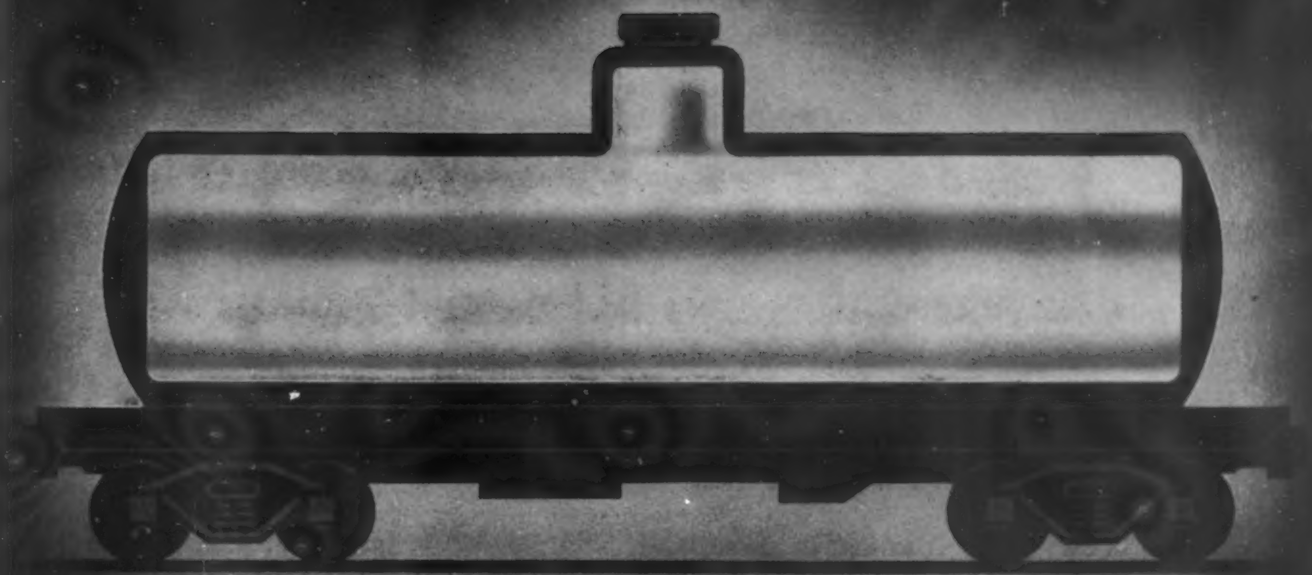
[a] Prior to each cycle the binocular or binocular body was conditioned for 3 days at 77° F. and 50 percent relative humidity.

11



***9** and **10**—Points at which the dimensional changes were measured over linear distances. **11**—Test results of the effect of impact on the optical alignment of the binoculars*

The Car With The "Silver Lining"



For Your Postwar Products

General American engineers are ready now to consult with you—to plan new tank cars with every feature needed to transport your products safely. Call or write our general offices—135 South LaSalle St., Chicago 90, Ill.

GATX GENERAL AMERICAN

FOR hard-to-handle commodities, General American has built tank cars with special protective linings of nickel, stainless steel, rubber and lead.

Now here's a car with a "silver lining." It's a General American tank car of the future. The "silver lining" represents all the new specialized coatings you may need to carry your postwar products—and that General American will provide. You will have, then as now, definite advantages through use of General American cars for *safe, sure,* low-cost transportation.

GENERAL AMERICAN TRANSPORTATION
CORPORATION

Builders and Operators of Specialized Railroad Freight Cars ★ Bulk Liquid Storage Terminals ★ Pressure Vessels and other Welded Equipment ★ Aerocoach Motor Coaches ★ Process Equipment of all kinds ★ Fruit and Vegetable Precooling Service

Table V.—Results of Accelerated-Moderate and Extreme Service Condition Tests on 6 × 42 Plastic Binocular[a]

Location of measurement as shown in Figs. 9 and 10	Total dimensional change for 5 cycles of moderate service conditions	Total dimensional change for extreme cycles A, B and C[b]
	percent	percent
1	−0.15	+0.10
2	−0.05	−0.10
3	−0.10	+0.10
4	−0.15	+0.20
5	−0.10	+0.10
6	−0.00	+0.20
7	−0.00	+0.30
8	+0.00	0.0
9	−0.10	+0.05
10	−0.20	+0.05
11	−0.10	+0.10
12	−0.05	+0.05
13	−0.10	+0.05
14	−0.05	0.0
15	−0.20	+0.10
Average dimensional change	−0.09	+0.10
Maximum optical deviation, min.	1.0 (measured)	1.1 (calculated)

[a] Prior to each cycle the binocular was conditioned for 3 days at 77° F. and 50 percent relative humidity.
[b] Test on unassembled binocular only.

Table VI.—Results of Impact Tests on 6 × 42 Plastic Binocular Housing[a]

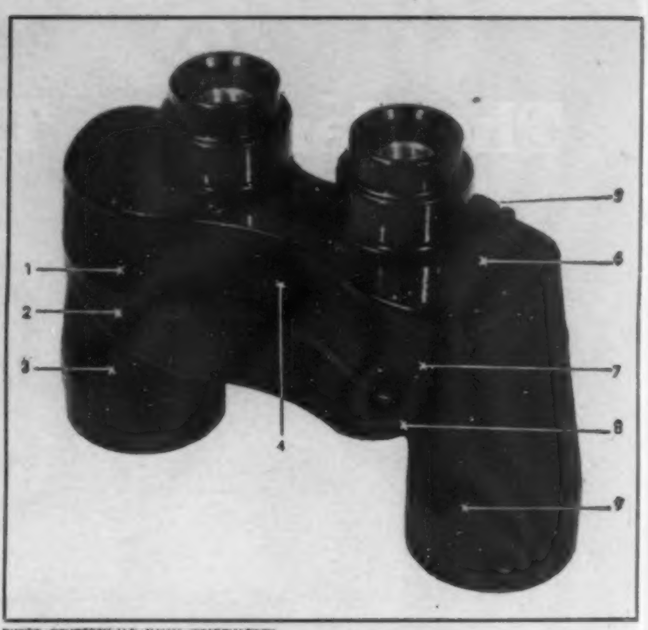
Impact points as shown in Fig. 12	Effect of impact of 130-gm. steel ball dropped from a height of: 15 in.	20 in.	25 in.	30 in.	35 in.	40 in.
1	nil	nil	nil	nil	nil	nil
2	nil	nil	nil	nil	nil	visual
3	nil	nil	nil	micro	micro	visual
4[b]	nil	nil	nil	visual	add	add
5[b]	nil	mar	mar	mar	micro	micro
6[b]	nil	micro	visual	extend	add	add
7	nil	nil	nil	nil	nil	nil
8	nil	nil	nil	nil	mar	mar
9	nil	nil	nil	nil	nil	nil

[a] Key to table:
nil = no effect.
mar = marring (surface).
micro = microscopic cracks.
visual = visible cracks.
extend = cracks extending.
add = additional cracks.
fail = failure.
[b] Impact points not related to the optical structural support.

Table VII.—Water Immersion Tests of 6 × 42 Plastic Binocular

Binocular type	Water pressure causing leakage[a]	Equivalent depth of water[b]
	p.s.i.	ft.
6 × 30 (standard)	0.5	1.1
7 × 50 (standard)	0.5	1.1
7 × 50 (waterproof)	0.7	1.6
7 × 50 (waterproof)	4.3	10.0
6 × 42 (plastic)	45	103.6

[a] Pressure at which initial leakage occurred.
[b] Calculations based on weight of water as 62.5 lb. per cubic foot.



PHOTO, COURTESY U.S. NAVAL OBSERVATORY

12—*The numbers indicate the nine points of impact on an unassembled binocular which were subjected to test*

signed as a 6 × 42 binocular, but it may readily be converted to a 7 × 50, the standard binocular for Navy use.

The plastic material provides not only a satisfactory replacement for aluminum, but possesses advantageous characteristics of its own which apparently assure plastics a permanent place in the manufacture of optical instruments.

The extreme resistance of the instrument to fungus growth, corrosion and moisture penetration, as well as its rugged construction and fixed adjustment features, makes the plastic binocular exceptionally well suited to specialized service such as night, tropical, amphibious, infiltration, small vessels and submarine use.

Fitted with a sturdy and serviceable plastic carrying case[1] which is now standard for the Navy in place of leather cases used heretofore, the combat binocular will soon find extensive application as a general-purpose military instrument. When wartime needs are filled, the binocular is expected to become available for civilian use.

Acknowledgment

The development work on the plastic binocular was carried out under the direction of the U. S. Naval Observatory Material Officer and with the cooperation of many employees in the U. S. Naval Observatory Material Department and the Organic Plastics Section of the National Bureau of Standards. Dr. I. C. Gardner and his associates in the Optical Instruments Section of the National Bureau of Standards cooperated in the design of the optical system.

The Molded Insulation Co. aided by molding of the preliminary samples, utilization of materials and technical assistance supplied by the plastic materials manufacturers, including the Bakelite Corp.; Durez Plastics and Chemicals, Inc.; Durite Plastics, Inc.; Makalot Corp.; and Plastics Div., Monsanto Chemical Co. Appreciation is also expressed for the noteworthy assistance of the Plastics Divs., General Electric Co.; Universal Camera Corp.; Doehler Die Casting Co.; Aluminum Company of America and the Society of the Plastics Industry.

[1] "Carrying Cases for Binoculars," by Lieut. W. R. Bailey, MODERN PLASTICS *21*, 75-7 (Dec. 1943).

Economical tooling

(*Continued from page 141*) plastic and metal tools comparable. However, since cast resin usually requires little or no contour finishing, labor and time are saved in the finishing of plastic tools as compared with metal dies.

The laminated dies are about comparable with typical zinc-alloy dies in first cost—a disappointment since original estimates indicated a 30 to 50 percent saving in both cost and delivery time. It is believed, however, that production economies will soon be effected as the result of a better selecting of cutting tools, personnel familiarization and design simplification. As it is, these laminated dies, because of their lightness, outclass all others in set-up, handling and storage cost, on the score of quality and rate of production. Lubricants appear to be far less critical and, in some cases, unnecessary when laminated tools are used—a circumstance that results in considerable part-handling and cleaning economy. For most services, the cost, time and satisfaction of performance appear clearly to favor the plastic die.

Thus far, the heaviest gages of metal that have been handled in forming are 0.064-in. 24 SO-ALC over a service shrink flange (about 20 percent shrink); 0.050-in. 4130 annealed; 0.050-in. body steel and 0.024-in. stainless steel. However, there is no reason to suppose that these gages represent upper limits. If parts and dies were made geometrically similar but twice as large as a set of tools presently in use, all forming strains and die stresses would, apparently, be identical for double the given material thickness—and the part would form.

Plastic drill and assembly jigs, trim fixtures, machine and nest fixtures, etc.—all seem to offer economies of time and cost over conventional hard-tooling practice. In most applications, performance is quite satisfactory for surprisingly long runs of parts. This is particularly true of cast-resin fixtures to fit or nest complex shapes. For applications where marked rigidity and permanence are not essential, still greater economies may be obtained from the use of the cast thermoplastics such as cellulose acetate butyrate. A wide variety of physical properties is obtained from alloys and mixtures of the thermoplastics and various fillers.

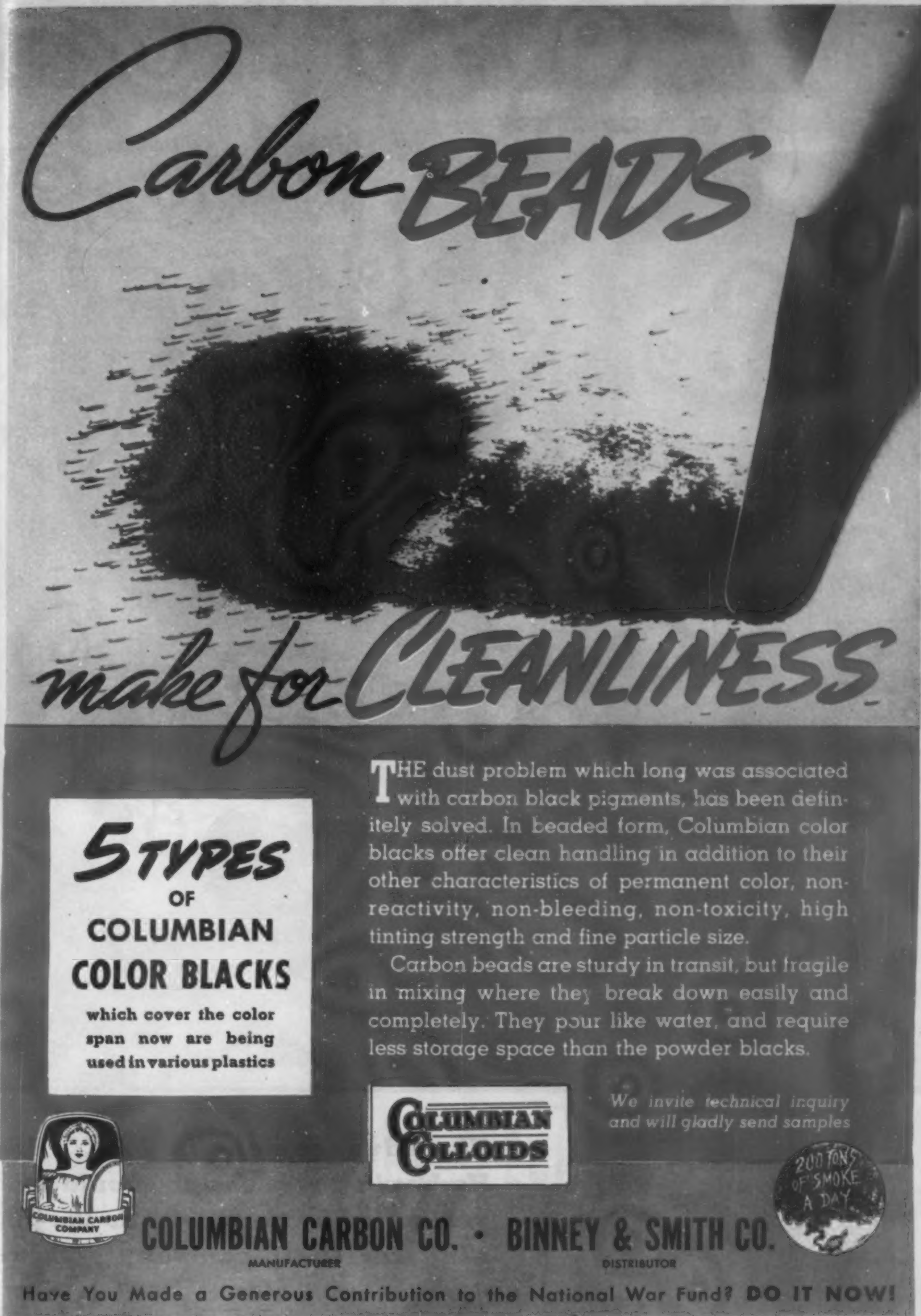
Oddly, the fabrication, forming and molding of the plastic materials themselves are one of the most difficult applications for plastic tools. This is due mainly to the wide temperature and moisture changes encountered in many of these operations. Of course, this type of tooling is difficult in any material, but continuous operation at temperatures of 300–400° F., especially where heat flow in the die or fixture itself is required, finds no suitable plastic presently available. A heat-resistant casting resin having high thermal conductivity and low thermal expansion while retaining good corrosion resistance and non-adhering qualities against common laminating resins, would be a welcome contribution to this field.

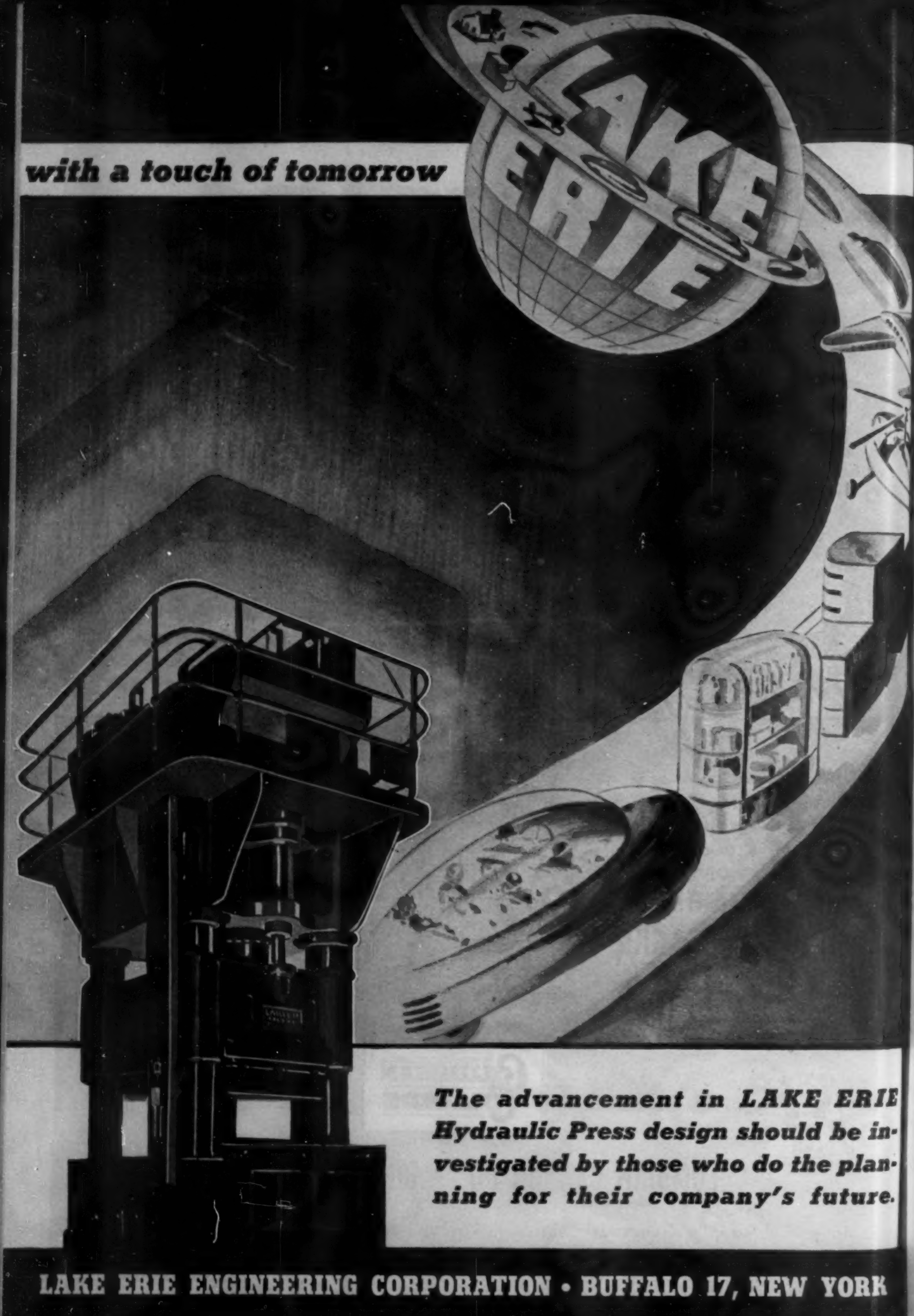
For example, to the writer's knowledge, no truly satisfactory autoclave die with a vacuum blanket is now in use for 300° F. steam at 100 p.s.i. One Los Angeles firm has tried the entire range of materials—from ceramics, cement, glass and casting resin to various metals—with little success. Failures occur from spalling, warping, corrosion, inability to cast or fire to tolerance, decomposition of material, excessive first cost and from several other causes. The writer has made an approach to the problem using styrene with glass flock filler. This material has proved fairly satisfactory, though rather expensive, when used with high-frequency heating. At lower temperatures (280° F.), a special concrete or alloys of casting phenolics appear to stand up well, even when cold-water sprayed on being removed from the autoclave.

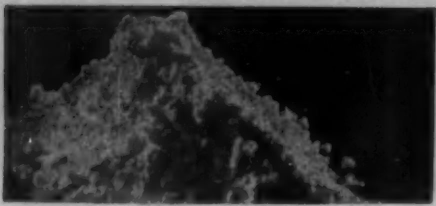
The detailed investigation of all types of tooling as to design, performance, etc., is beyond the scope of this article. However, Table I represents an attempt at a qualitative evaluation of design criteria and characteristics thus far used. The table also suggests a few of the many materials available.

TABLE I.—COMPARISON OF VARIOUS TYPES OF TOOLING

Tool	*Material*	*Least mfg. time*	*First cost*	*Set-up and hand-time cost (W. T.)*	*Prod. cost and convenience*	*Reliability (breakage dim. stability)*	*Ease of design change*	*Life*	*Total*
	Relative weight	10	10	5	10	5	5	10	55
Form blocks, router blocks, etc.	Plaster	10	10	4	1	0	3	1	29
	Wood	10	10	5	2	1	5	1	34
Simple jigs	Lignin	9	8	4	7	3	4	5	40
	Zinc alloy	5	5	2	10	4	2	7	35
	Steel	2	1	1	10	5	0	10	29
Form dies	Lignin	7	6	5	9	3	5	5	40
Large or complex drill and assembled jigs	Phenolic laminated	6	4	5	9	3	4	6	37
	Cast phenolic	9	10	4	10	2	3	7	45
Pierce dies	Thermoplastic	10	8	4	8	2	5	4	41
Machining fixtures	Zinc alloy	4	4	2	5	3	2	6	26
Stretch blocks	Steel	2	2	1	6	5	1	10	27
Draw dies									
Laminating dies	Plaster	10	10	3	2	1	2	1	29
Autoclave dies	Wood	7	9	4	2	2	5	1	30
Glue jigs	Masonite	6	5	4	7	3	4	6	35
C Stage dies	Phenolic laminated	5	3	5	7	4	4	7	35
	Cast phenolic	9	9	3	8	3	3	5	40
	Zinc alloy	7	4	1	9	4	2	4	31
	Cast aluminum	6	4	2	10	3	2	10	37
	Cast iron	3	5	1	10	5	1	9	34
	Concrete	10	10	2	5	2	1	2	32

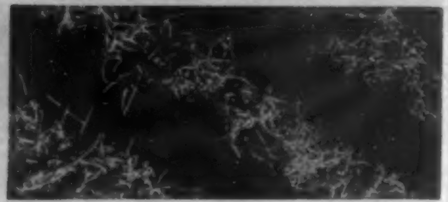

Carbon BEADS
make for CLEANLINESS
THE dust problem which long was associated with carbon black pigments, has been definitely solved. In beaded form, Columbian color blacks offer clean handling in addition to their other characteristics of permanent color, non-reactivity, non-bleeding, non-toxicity, high tinting strength and fine particle size.
Carbon beads are sturdy in transit, but fragile in mixing where they break down easily and completely. They pour like water, and require less storage space than the powder blacks.
5 TYPES OF COLUMBIAN COLOR BLACKS
which cover the color span now are being used in various plastics
COLUMBIAN COLLOIDS
We invite technical inquiry and will gladly send samples
COLUMBIAN CARBON COMPANY
200 TONS OF SMOKE A DAY
COLUMBIAN CARBON CO. • BINNEY & SMITH CO.
MANUFACTURER
DISTRIBUTOR
Have You Made a Generous Contribution to the National War Fund? DO IT NOW!


with a touch of tomorrow
LAKE ERIE
The advancement in LAKE ERIE Hydraulic Press design should be investigated by those who do the planning for their company's future.
LAKE ERIE ENGINEERING CORPORATION • BUFFALO 17, NEW YORK



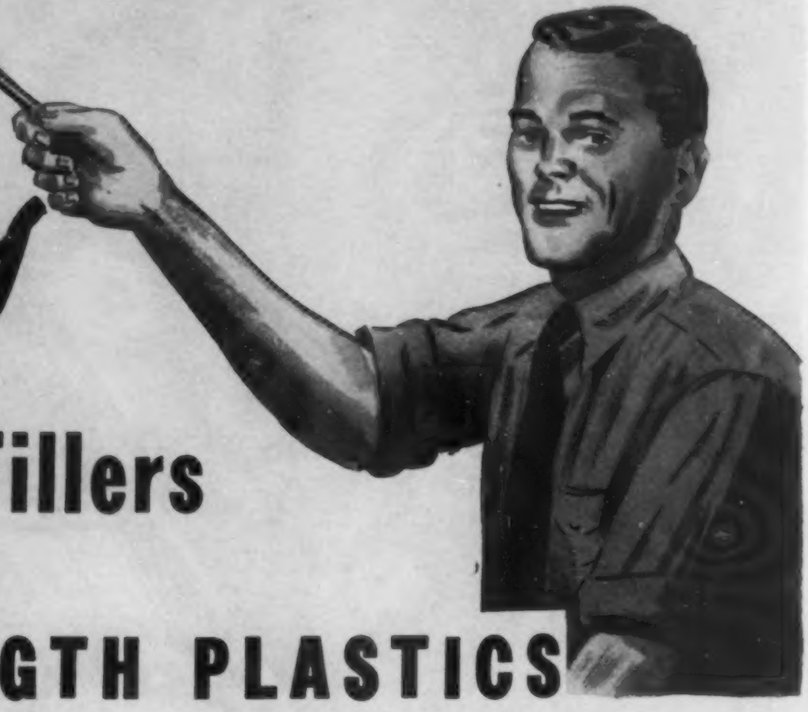
FILFLOC Pure cotton flock of surpassing cleanliness and uniformity.

FABRIFIL Macerated cotton fabric for extra strength.



CORDFIL Evenly cut lengths of tire cord: for plastics of utmost strength.

3 types



of "RAYCO" Fillers
for
EXTRA-STRENGTH PLASTICS

In our specialized field of Fillers, we have endeavored to match in care and thoroughness the research efforts of plastics technicians. As a result, you receive from Rayco not merely general types of fillers, but also a wide variety of different cuts in each type.

Your compound manufacturer gets prompt and intelligent cooperation from us in determining just the right filler for your purpose.

And once the specifications are determined, he knows he can depend on Rayco for strict adherence to them, assuring the dependable results that come from good, solid standards of uniformity and quality control.

For "know-how" on Fillers, consult Rayco.

AVAILABLE . . . PLASTIC HELMET LINER SCRAP

We have on hand a supply of macerated scrap of the material used to make the plastic liner for helmets. This is an excellent low-priced molding compound of the phenol formaldehyde type. Inquiries invited.

RAYON PROCESSING CO. of R.I. INC.
60 TREMONT ST., CENTRAL FALLS, RHODE ISLAND

Developers and Producers of Cotton Fillers for Plastics

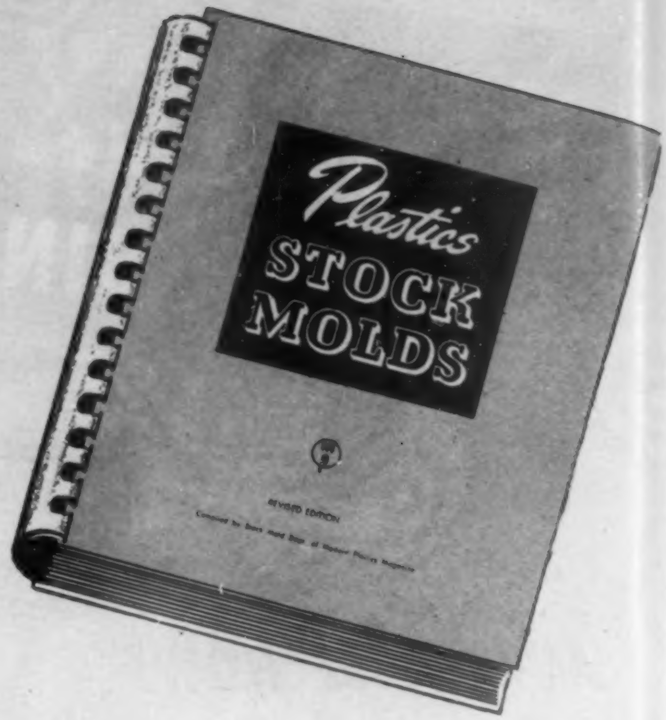
OBTAIN COMPOUNDS CONTAINING RAYCO FILLERS—FOR GOOD FLOW AND EXTRA STRENGTH

PLASTICS

STOCK MOLDS

VITAL IN

RECONVERSION



One plastics user has recently stated that stock molds are absolutely indispensable in plastics reconversion. Likewise, they are vital to every user of plastics!

Modern Plastics' staff has collected nearly 1600 current plastics stock molds. These molds include flashlights, shaving accessories, textile accessories, hair ornaments, cosmetic containers, trays, office equipment, frames, household products, lamp bases, plumbing hardware, electric and general hardware, clock cases, medical applications, boxes and containers, handles, closures, knobs, smoking accessories, games and novelties, jewelry, etc., etc.

Every one of these molds is illustrated by a photograph of the item molded in it. Each stock mold is numbered and indexed by the name of the molder who owns it. Stock molds are all cross-indexed by subject.

Included as well are two brand-new special sections of material never before collected. The first is extrusions. All stock extruded parts are illustrated with cross-section drawings and are indexed both by the maker's name and by number. Likewise, all laminates including sheets, rods and tubes are listed together with the names of the manufacturers.

Already, hundreds of enthusiastic letters from buyers of the PLASTICS STOCK MOLD BOOK testify that the volume is not only important, it is absolutely indispensable to anyone who buys or uses plastics. As one important plastics user says, "this book is worth many times $5.00 to me and should have the same value to anyone. All you have to do is find the stock mold you can use and you have saved yourself hundreds or even thousands of dollars as well as a great deal of time and effort."

The number of copies of this book is strictly limited by current paper quotas. Orders are now being filled at $5.00 per copy (foreign and Canadian $6.00).

PLASTICS

STOCK MOLDS

122 E. 42nd ST. NEW YORK 17, N. Y.

PLASTIC STOCK MOLD BOOK
122 East 41st St., New York 17, N. Y.

Please send me .... copy(ies) of the new STOCK MOLD BOOK @ $5.00 per copy. (Foreign and Canadian $6.00)

My remittance is enclosed

Name ....

Firm ....

Address ....

"I'M THROUGH WITH PLASTICS!!!"

The old man was really sore. His production engineer couldn't get a word in edgewise. "I'm through," he repeated. "These plastics are no good. Just *look* at what's happened to those units. If that plastics salesman comes around here again, just send him in to me!"

We sympathize with the "old man," but he really ought to learn that the term "plastics" embraces scores of different materials having widely varying characteristics. He bought trouble when he was sold a highly regarded plastic that was totally unsuited to his job.

If you have a production problem which you think might well be solved in plastics, you can proceed in two ways. One method is to thumb through a list of plastics manufacturers and give each salesman a chance to push his product. The other method is to "Call on Creative" and let an expert, with no particular material to sell, study your problem and advise you which type of plastic, *if any*, will do your job best.

Creative has no plastic axe to grind. It produces plastic parts made from laminates, cast phenolic resins, methacrylates and acetates, to mention only a few materials.

We have no ties to any particular type of plastic and we decide independently which plastic we will recommend for your job.

Get the habit of applying our "know-how." ... Call on Creative.

Creative

CP PLASTICS CORP.

960 KENT AVE, BROOKLYN 5, NEW YORK

Beautify and IDENTIFY

YOUR PRODUCT IN ONE FAST, LOW-COST OPERATION

and keep them beautiful and smartly identified right up to the point of re-purchase . . . with Meyercord Decals. Available in any design, size or colors, Meyercord Decals offer hand-painted effects at a fraction of the cost. And because they're washable, durable and alcohol-proof, they *keep* your product name permanently fresh and bright. Easily applied at production line speed to glass, wood, pottery or metal, on smooth, crinkled, flat or curved surfaces—Meyercord Decals are the smart, modern method of product identification. Give your products new eye-appeal and buy-appeal. Identify and beautify them with Meyercord Decals. Address inquiries to Dept. 21-10.

Meyercord Decals

THE MEYERCORD CO., CHICAGO 44, ILLINOIS

Illustration of Jaquet products, decorated and identified with Meyercord Decals, courtesy of Jaquet, Inc., New York, N.Y.


and they all tell the story of
TULOX
the Extruded Plastic Tubing with "no end of" end uses
Giant bombers, card-index files, sunstills, plumbing fixtures, black lights, musical instruments, freezing coils, floating lanterns, fountain pens . . .
They, and hundreds of other unrelated products are proving the versatility and practicability of TULOX Extruded Plastic Tubing.
TULOX is manufactured by our *exclusive* process from many different base resins, in simple or complicated cross-sections and to *micromatic* tolerances. TULOX can be in color or colorless—transparent, translucent or opaque.
TULOX has proved itself on the fighting fronts and in industry—and has taken its well-earned place as an important material in its own right.
TULOX Tubing is not "just another plastic tubing." It is a quality product with unusually interesting possibilities for today and post war.
. . . and it may solve one of *your* problems as it has solved so many others.
Write for TULOX *end-use photos and data sheet.*
Extruded Plastics, Inc.
NEW CANAAN AVE., NORWALK, CONNECTICUT, U.S.A.
IN CANADA: DUPLATE CANADA, LTD., PLASTIC DIVISION, OSHAWA, ONTARIO

New W-S Horizontal Injection Molding Machine — capacity range: 8 to 24 oz.

suggested by your fellow molders

We asked molders to suggest improvements to the first models of W-S standard Injection Molding Machines. Now ... here they are ... incorporated in the new W-S 6 to 24-ounce Horizontal Injection Machines.

The consensus, based on Molders' experience with W-S machines, was not to change certain W-S features on the injection end, such as:—

- **Accessibility of the heating cylinder which permits changing the plastic material in the cylinder without removing it from the machine.**
- **The simple method of locking the heating cylinder to the cylinder bracket, enabling a quick change of the heating cylinder when desired.**

Changes suggested—and followed—are:—

- **Improved heating cylinder to enable high plasticizing capacities at lower injection pressures. This is accomplished largely through zone heating control and a newly designed torpedo, the cold end of which is electrically heated. The material is thus preplasticized prior to being forced over the heated end of the torpedo which is fully streamlined with no supporting fins.**
- **Clamping end has been changed so that clamping is now done by a hydraulic cylinder controlled automatically — eliminating necessity of adjustment for varying mold thicknesses. Definite clamping capacity is assured by a holding pump whose pressure is adjustable over a wide range, without any connections with the injection power unit.**

Why not try a machine that has been approved and improved by molders themselves on the basis of experience? This is one unit of the most complete line of injection and compression molding machines manufactured. The Watson-Stillman Company, Roselle, N. J.

WATSON-STILLMAN

DESIGNERS AND MANUFACTURERS OF HYDRAULIC EQUIPMENT, FORGED STEEL FITTINGS AND VALVES

PROGRESS!

In 18 B. C., riding to war in chariots was in step with the progress of that age, just as fastening various items of equipment with slotted head screws and other equally out-moded fasteners, was appropriate in 1914.

Today we ride to war on wings fastened by rivets. Countless other vital war products are now fastened with PHILLIP'S Recessed-Head SCREWS—both fasteners in tempo with progress as of 1944.

MILFORD manufactures modern fasteners to today's standards of precision and service. May we help you modernize your fastenings for tomorrow's peacetime needs?

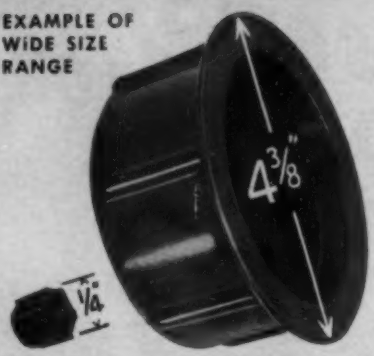
The MILFORD RIVET & MACHINE CO.

EASTERN DIVISION — CENTRAL DIVISION
MILFORD, CONN. ★ ELYRIA, OHIO.

CONTRACT PLASTICS MOLDING

INJECTION AND COMPRESSION MOLDING IN ALL THERMOPLASTIC AND THERMOSETTING MATERIALS

EXAMPLE OF WIDE SIZE RANGE



We have the set-up and experience to give you the best in plastics molding of small and large parts, in small or large quantities, at reasonable prices

QUOTATIONS on specific requirements without obligation

S.S.WHITE PLASTICS DIVISION

THE S. S. WHITE DENTAL MFG. CO.

DEPT. M, 10 EAST 40th ST., NEW YORK 16, N. Y.

FLEXIBLE SHAFTS — AIRCRAFT ACCESSORIES — MOLDED PLASTICS — MOLDED RESISTORS — FLEXIBLE SHAFT TOOLS

PITMAN CORRESPONDENCE COLLEGE

(Sir Isaac Pitman & Sons Ltd.)
166, Southampton Row
London, W. C. 1., England

offers
a course of lessons
on
PLASTICS

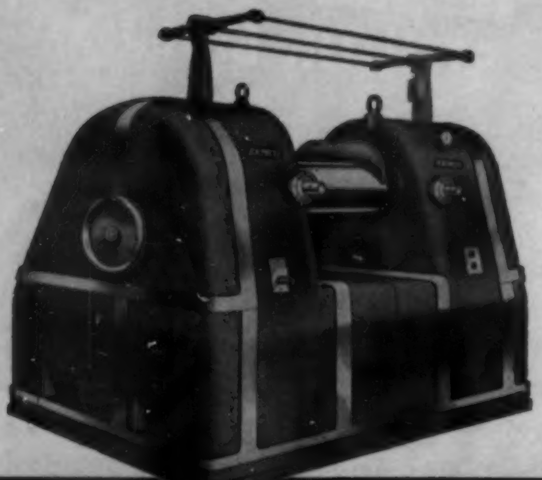
★

The Course is being prepared by a team of experts and has the approval of The Institute of Plastics Industry.

For Particulars apply Principal:

R. W. Holland, O.B.E., M.A., M.Sc., LL.D.

LABORATORY MILL



for sheeting, milling and breaking down plastics material

MEETING the need for small mill production and experimental batches of materials, in both rubber and plastics, the EEMCO Laboratory Mill is an entirely enclosed unit complete with motor and variable speed drive, ready to operate. No specially built foundation is needed—therefore reduced installation costs are possible. Write for folder BR2

★ ★ ★

MILLS • HYDRAULIC PRESSES • TUBERS
EXTRUDERS • STRAINERS • WASHERS
CRACKERS • CALENDERS • REFINERS

★ ★ ★

EEMCO

Erie Engine & Mfg. Co.

953 EAST 12th ST., ERIE, PENNA.

WE build molds for all plastics

More than 20 years of successful experience as toolmaker to leading custom and proprietary molders qualify us as your mold designer and mold maker on your most exacting jobs of plastics engineering.

Fortney MANUFACTURING COMPANY

MOLDS FOR PLASTICS

247 N.J.R.R. AVE. ★ NEWARK, N. J.

HOW MISKELLA INFRA-RED OVENS AND APPLIANCES SERVE THE PLASTIC INDUSTRY

Branch of the Industry	Name of Appliance	Use
Molders (Thermo-setting) Compression	PELLET-VEYOR (Variable heat)	To preheat pellets and preforms at the press as needed
Molders (Thermo-plastic) Injection	VIBRA-VEYOR (Variable heat)	To preheat plastic powder automatically. To dry plastic powder automatically
Injection	HOPPER-HEATER (Variable heat)	To warm up heavy metal of hopper of molding machine
Molders (Thermo-plastic) Extrusion	STRIP-HEATER (Variable heat)	To preheat strip rolls of vinylite, etc., automatically as fed to worm
Material Manufacturers	Special production Equipment including vibrators, conveyors, stainless steel belts and electronic devices	To process various kinds of plastic material in bulk
Fabricators (Miscellaneous)	BENCH-KIT In various sizes (Variable heat)	To soften sheets, rods, tubes and any shape for bending, forming punching, etc. This includes Cellulose, Acetate, Methyl Methacrylate

(The time on most of the operations mentioned above averages five minutes)
We sell lamps and build completely engineered infra-red equipment and appliance installations.

Drying, Baking, Processing and Preheating Specialties

INFRA-RED ENGINEERS & DESIGNERS

MANUFACTURERS
Main Office and Laboratory
1637 East Fortieth Street, Cleveland, Ohio

MOLDED PLASTICS
for
NEW PRODUCTS

Continuous

PLASTIC SHEETS

CARTER extruded sheet stock of Cellulose Acetate, Cellulose Acetate Butyrate, Ethyl Cellulose or Vinylite is now available in continuous rolls for high speed punch press operation. We can furnish in widths up to 8″ in any desired thickness up to 1/16″ and in all colors.

In the making of its famous protective masks, The Martindale Electric Company of Cleveland uses CARTER sheet stock for two reasons: First, because it measures up to the high quality standard of its product and second, because it materially speeds up production.

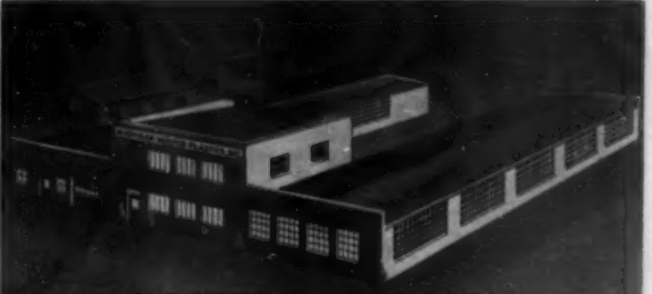
Other extruded CARTER products include rods of all shapes and sizes, tubing, tape and special continuous shapes to order.

Let us figure on your requirements.

CARTER

PRODUCTS CORPORATION

6921 Carnegie Ave. • Cleveland 3, Ohio



"LITTLE GIANT"

America's largest concerns have sent their buyers to investigate why it is that molded plastics products from Michigan Molded Plastics, Inc., Dexter, Michigan, are of such uniformly high quality. Furthermore, they want to know how it is possible to produce so much from such a comparatively small plant.

They come. They are amazed. They are convinced. They go back home with the knowledge that experience and "know-how" are the reasons this modest plant with its peaceful surroundings is called the "Little Giant" of the plastics industry.

MICHIGAN MOLDED PLASTICS, Inc.

Dexter M *Michigan*

CUSTOM MOLDING

COMPRESSION • INJECTION • EXTRUSION

NUMBERALL

NUMBERING and LETTERING PRESS

Write for Bulletin MP 240

An ideal machine for hot stamping letters and figures on plastic nameplates, and other small parts, with the use of colored roll leaf. Furnished with an electric heating element, and rheostat for regulating heat. All figures and entire alphabet are on one dial.

We also make numbering machines...automatic and non-automatic...for stamping, either hot or cold, numbers and letters into various materials.

NUMBERALL STAMP & TOOL CO.

HUGUENOT PARK STATEN ISLAND 12, N. Y.

THERMOPLASTICS WELDED ELECTRONICALLY

The Richardson-Allen Thermoplastic Welder makes a bond as strong and as moisture-tight and air-tight as the material itself. It works successfully on Koroseal, Vinylite, Saran, and Pliofilm and many other thermoplastics.

The weld is made by simply passing the material through a pair of rotating or bar electrodes. Between these electrodes a high frequency field is created, causing a heat within the material rather than on the surface. The electrodes remain at room temperature.

This process is surer than sewing or cementing and does not injure the materials welded. In fact, the weld becomes the strongest part. Adaptable to many sizes and thicknesses of material. Write for further particulars.

WELDED BY ELECTRONICS

No extra material is required for the process, but may be used for decorative effect and reinforcement. Welding rate is 15 to 30 feet per minute. Both the heat rate and bonding rate are conveniently controlled by a foot pedal.

RICHARDSON-ALLEN ELECTRONIC PLASTIC WELDER

RICHARDSON-ALLEN CORP., 15 W. 20th St., New York 11, N. Y.

NOW YOU CAN DO YOUR OWN BRANDING on PLASTICS!

WE SHOW YOU HOW

WE ENGINEER THE JOB

WE BUILD THE TOOLS

★ Rogan's exclusive plastic branding process has been employed extensively to speed production of many important war plastics. The bakelite Azimuth Dial illustrated, is one example of Rogan's accuracy in branding. In fact, this important assignment was entrusted *only* to Rogan.

However, wartime demands for this service in some ordnance plants, have required the application on their own premises. So, Rogan engineers have arranged a method whereby anyone can do his own branding on plastics right in his own plant. Rogan will engineer each job completely and build all the necessary tools. Will provide clear, simple instructions that will permit anyone to do the job expertly. All you need do is to send us blue prints and other specific data, and we'll give you a quick cost and time estimate.

Take advantage of this *new* Rogan service...send us your specifications today.

ROGAN BROTHERS

2005 S. MICHIGAN AVE. CHICAGO 16, ILLINOIS

All classified advertising payable in advance of publication. Minimum, $5.00 (up to 60 words); in border, $10.00 per inch.

Classified Advertisements

For further information address Classified Advertising Dept. MODERN PLASTICS 122 East 42nd St., New York 17, N. Y.

WANTED: PLASTIC SCRAP OR REJECTS in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Acrylic and Vinyl Resin materials. Submit samples and details of quantities, grades and color for our quotations. Reply Box 508, Modern Plastics.

Arthur Swanson & Associates

PRODUCT DESIGN

Executing designs for post-war manufacturing.

540 N. Michigan Ave., Chicago 11, Ill.

WANTED: Experienced man to operate autoclave in plant manufacturing synthetic resin. Reply Box 1078, Modern Plastics.

TWO ENTERPRISING YOUNG MEN with excellent references seek contact with manufacturers to begin immediate sales of plastic products throughout California. Desire agencies for homeware and novelty products in particular. If interested write Box 1079, Modern Plastics, as we are able to assume complete sales cost.

INVEST IN THE POSTWAR FUTURE of plastics. A group of men thoroughly trained in the fabrication of new wartime resins are planning to go into business for themselves after the war. This group of specialists in their respective fields believe contact curing pressure resins to have an undaunted future in postwar plastic markets. All that is lacking is the capital to start this organization going. If this is of interest to you write for further information. Reply Box 1080, Modern Plastics.

FOR SALE: 1—500 ton Hydraulic Press with downward moving ram and pushbacks. Box 512, Modern Plastics.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

FOR SALE

30,000 Lbs.

NEW ACETATE CUTTINGS (RAGS)

ATLANTIC BY-PRODUCTS CO.

154 Nassau St.

New York 7, N. Y.

EXTRUDED PLASTIC STRIP FOR SALE Dow Ethocel, ½" x .030", 44 yards per pound, put-up 60 pound reels continuous length. Colors and quantities:

Peach	1342 lbs.	Ivory	165 lbs.
Pastel green	702 lbs.	Pastel blue	1162 lbs.
White	447 lbs.	Black	56 lbs.

Price 80¢ net per pound f.o.b. Cincinnati, Ohio.

The Chas. W. Breneman Co.
2045 Reading Rd., Cincinnati 2, Ohio

ATTENTION PLASTIC MOULDERS: We are a young, hard-hitting manufacturing company. We plan to use our sales facilities fully by taking on a plastic line, as it will not compete with what we manufacture. We actively sell leading department stores, gift shops and chains throughout the country. We have two showrooms in New York and permanent displays in Chicago, Dallas and San Francisco. We can do more than sell your products—we can merchandise them for you. If you are still in the designing stage, we know we can help you. Contact us now!
Box 1081, Modern Plastics

FOR SALE—1 Worthington Hyd. Pump 1 x 6, 5 GPM 6000 pressure M.D. 1 Hyd. Press 24" x 24", 14" ram; 1 Battery of 2—15 x 36 compounding rolls with drive at 75 HP motor; 1 W. S. 15" x 18" Hyd. Press, 10" ram; 1—14" x 24" Press, 9" ram; 4—24" x 55" steel cord Heating Platens; 4—W. & P. Mixers; 4—Semi-Automatic 100-ton Hydr. Presses, platen area 20" x 36"; Allen 6" Tuber; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box 447, Modern Plastics.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

Spence & Rigolo

PRODUCT DESIGN & ENGINEERING
MARKET RESEARCH

677 Fifth Ave., New York 22, N. Y.

TRENTON, New Jersey, Manufacturer wants experienced practical Plastics Engineer on part time or consulting basis to help solve injection molding problem. Reply Box 1076, Modern Plastics.

FOR SALE: Approximately 9000 Lbs. Olive Drab Dow's Ethocel Plastic Granules Type CD 1943 Color 274 Flow H3. Reply Box 1082, Modern Plastics.

POSITION WANTED

Young man, 30 years old, married, 2 children, Graduate Plastics Industries Technical Institute, High School, 2 years College, 11 years selling and executive sales experience desires connection in plastics field, preferably Eastern seaboard. Reply Box 1083, Modern Plastics.

EXECUTIVES — ENGINEERS — $5,000–$15,000 CALIBER. Through our nationwide Service we are conducting negotiations for good-salaried positions with well-established corporations possessing postwar futures. Your personal requirements met by individual procedures which will not conflict with War Manpower Commission regulations. Strict confidence assured. Details on request. Jepson Executive Personnel & Research Service, 670 Land Bank Building, Kansas City 6, Missouri.

WELL CONNECTED Sales Engineering Firm, with office in New York, seeks postwar representation of manufacturer of plastic mouldings, extrusions and/or laminates. Reply Box 1084, Modern Plastics.

SALES PROMOTER WITH IDEAS—Creator, Inventor, Sales Promoter and Agent, offers Ability and Experience to Create New Ideas, Suggest Products, Find Markets for Reliable Concern. Have N. Y. Office. Open for Proposition with Unusual Opportunity. Box 1085, Modern Plastics.

MANUFACTURER'S AGENT now intensely selling all types of trade in the New York Metropolitan area in the houseware, hardware and drug sundry field would like to represent a manufacturer of a strong line of plastics. Reply Box 1087, Modern Plastics.

POSITION WANTED. Draftsman-designer, two years' experience in mold design, injection, compression, transfer. One year experience in product design. Married, draft exempt. Would like position with organization offering postwar opportunity. For further information and references, write Modern Plastics, Box 1088, Modern Plastics.

EXPERIENCED FIRM of Sales Representatives covering Pacific Coast Area, well rated and with excellent contacts, desires permanent connection with progressive manufacturer of plastic materials and specialties for present and postwar periods. Our services include: sales, warehousing, distributing and advertising. Our representative, who is well grounded in plastics engineering, will be east for personal interviews and discussions during the month of October. Reply Box 1090, Modern Plastics.

TO THE COMPACT MANUFACTURERS

The French Powder Puff Company, 90 Prince Street, New York 12, N. Y., Telephone CANal 6-4840 is manufacturing any size, shape, and color in Sifters, Powder Puffs, and Bags. SPECIALIZED FOR THE COMPACT TRADE.

INTERESTED IN PURCHASING one or more six, eight or twelve ounce injection machines of standard make. Box 1086, Modern Plastics.

CHEMICAL ENGINEER: Rubber, plastics, synthetic resins, coatings, adhesives. Presently employed New York City area wishes change. American, age 38. Minimum salary $9000.00. Have excellently equipped laboratory and will consider undertakings on consultant fee basis. Box 1089, Modern Plastics.

FOR SALE: W. S. Transfer Molding Press, 75 Ton Vertical Cylinder, 225 Ton Horizontal Cylinder; Farrel-Birmingham 36" x 36", 12" Ram; Morane 30" x 36", 10" Ram; Watson-Stillman Hydr. Presses—12" x 12", 7½" Ram; 40 Ton Downstroke Broaching Press; 24" x 36", 6" Ram; 22" x 24", 5½" Ram; 25" x 36", Two 5" Rams; 48" x 26", four 3½" Rams; 78" x 36", two 7½" Rams; 400 ton Hydr. Extrusion Press; W. S. 4 plgr. High & Low Pressure Hydraulic Pump; H. P. M. Vert. 2 plgr., High & Low Pressure; Wat.-Farrel 1¼" x 4", Vert. Triplex, 6½ GPM, 3500 lbs.; Goulds 2½" x 8" Vert. Triplex 30 GPM, 1600 lbs.; 4½" x 12" Horiz. 4 plgr., 165 GPM, 900 lbs.; Elmes 1¼" x 4" Horiz. 4 plgr., 8½ GPM, 4000 lbs.; 1" x 4" & 1½" x 4" Horiz. 4 plgr., 5 to 6½ GPM, 4500 & 5500 lbs.; H. P. M. Hydr. Steam Pump 20" x 6" x 22", 1500 lbs.; Low Pressure Pumps; Hydr. Accumulators, Tank & Weighted Types, up to 4000 lbs. pressures. Royle #2 Extruder or Tuber; ½" & ¾" Preform Tablet Machines. Heavy duty double arm Mixers up to 150 gals.; new Ball & Jewell Rotary Cutters; Grinders, Pulverizers, Gas Boilers, etc. ONLY PARTIAL LISTING. SEND US YOUR INQUIRIES. WE ALSO BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO., 426 BROOME ST., NEW YORK 13, N. Y.

NEW YORK CITY METAL FACTORY now doing war work seeks services of experienced tool room supervisor. Mechanical engineer with knowledge of plastics preferred. Starting salary $7,500 per year. Write stating experience, etc. Box 1091, Modern Plastics.

MANUFACTURERS AGENT

Established manufacturers' representative with important following in the handbag industry has openings to represent: (1) A plastics Molder (2) A Fabricator (3) A manufacturer of simulated leather (4) A manufacturer of trimming. Long established, financially able. Will give references, of course.

Your letters will be held in strict confidence.

Reply Box 1092, Modern Plastics

POSITION WANTED

With aggressive, post-war minded concern as Midwest representative of injection, compression and extrusion molded products. Willing to establish office at own expense. Reply Box 1095, Modern Plastics.

RESIN TECHNICIAN. This is the opportunity for a personable chemist or Engineer to handle resin service problems for an established company. Prefer man with laboratory or field experience in liquid phenolics who can organize his own work and use the facilities of a complete research laboratory. Forward particulars on education, experience, salary expected and photo. Positions open for location at Chicago and the Pacific Northwest. Release to an essential industry will be required. Reply Box 1093, Modern Plastics.

KNOWN WIDELY throughout the plastics industry. Available October 15th. Resigning from present job because of desire to return to New York City. Highest recommendation from present employer. Age 31, married, draft status 2AF with Army discharge. Want New York representation for concerns interested in plastics. Box 1094, Modern Plastics.

FOR SALE: Hydraulic Presses 600 Ton Watson Stillman 24" x 24", 4—36" x 36", 12" ram, 4—2 post 20" x 20" 8" rams, 1—52" x 26" 14" ram, 6—12" x 12" 7½" rams, 1—20" x 20" 14" ram, 2—30" x 52" 1 with 15" ram, 4 openings, 1—with 6" ram 3 openings, 1—Mystic Toggle 15" x 17", 1—14" x 20" Combination Hydraulic Toggle, Pumps: 1—Watson Stillman duplex high and low pressure ¾ GPM 4000 lbs. continuous bedplate, Hele Shaw JLP 12 44 GPM 1200 lbs. HPM triplex 1 ¾ GPM 2000 lbs. on high 16 GPM 400 lbs. on low V Belt drive, Robertson Triplex 5 GPM 5000 lbs., Union Steam Pump Viscolizer 3 GPM 2500 lbs. lbs., 2 Hauser Pumps 4 plunger 4.6 GPM 5000 lbs. on high 20 GPM, 500 lbs. on low, Gould Triplex 35 GPM 1500 lbs., Accumulators: Watson Stillman hydro-pneumatic accumulator 9 GPS 6000 lbs., tank type 4" dia. 4' stroke plunger, weighted type 5" dia. 6' stroke plunger, Extruders, Mills, Calenders, Mixers, etc. Advise your Requirements. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 285 Hudson Street, New York City 13.

FOR SALE: 1,000 20" x 50" sheets .020" Green transparent Cellulose Acetate. Still in original cases as received from factory. Box 1102, Modern Plastics.

ATTENTION MANUFACTURERS.
Sales promotion executive, Plastics Institute graduate, highly successful, nation wide contacts with chain store organizations, long established New York Office, will promote new products or old on commission arrangement now, or when available. Shipping facilities and financing at your option. Please write to Box 1058, Modern Plastics.

OPEN FOR BUSINESS CONNECTION. Designer and Fabricator of Plastic Items. Specializing in "LUCITE" and "PLEXIGLAS" articles for the Gift, Furniture, Jewelry and Architectural field, Automotive Industry, Radio and Television. Owns completely equipped plant in New Jersey available for the Fabrication of all items including large acrylic lenses. Years of experience in the Fabrication of plastic furniture, gift items and technical instruments. Can make new plastic items for sales promotion. For further information. Communicate Box 1097, Modern Plastics.

AVAILABLE to a Manufacturer An Experienced Custom Molding Sales Executive:
With a balanced conception of the Sales and Manufacturing problems that will entangle the industry with conversion under heavy tax burden.
My background is one of responsibility from a localized beginning to one semi-national in scope and while it's been liberal on the side of marketing, it does include Plant Management, Compression, Injection and Die Shop Operation. I have trained and directed with salary mechanically minded Sales Engineers with a simultaneous experience of appointing manufacturers agents on commission and then work with them to simplify the mechanics that profitable sales volume would result abridged. My resume is rounded, successful and substantial. To be referenced within the industry and by those with whom I have associated. Reply Box 1100, Modern Plastics.

PRODUCT DEVELOPMENT
INDEPENDENT INVENTOR,

Thoroughly experienced in plastics, will develop your ideas on a straight fee or royalty basis. No obligation for inquiries

NEW IDEAS for NEW PROFITS

Reply Box 1101, Modern Plastics

DRAFTSMAN-ENGINEER: Duties to include designing of die casting dies and fixtures for progressive manufacturing plant located in New York City, established over 25 years. Permanent post-war position. Excellent future. Give full details of experience and salary desired to start. Reply Box 1103, Modern Plastics.

TEN PLASTICS TECHNICIANS WANTED

(excellent remuneration)

Long established technical school, pioneers in plastics education, expects to employ now, and at the termination of the war, a number of plastics technicians, from all branches of the plastics industry, to assist as heads of departments, and teachers, in a practical plastics engineering training program. School has very high entrance qualifications for students. Located in the HEART of the plastics industry, 7 miles from New York City, 80 miles from Philadelphia. Within walking distance of Du Pont, Bakelite, Celanese, etc. Over 100 other firms engaged in the plastics business are located within our trading area. Applicants must have a minimum of three years experience in the industry. Write Mr. George Streisguth, Supt., New York Technical Institute (of N. J.). Established 1910. 158 Market Street, Newark, N. J.

INDEX TO ADVERTISEMENTS

MODERN PLASTICS*
PLASTICS*
PLASTICS ENGINEERING*
PLASTICS PRODUCTS*
*REG. U. S. PATENT OFFICE

MODERN PLASTICS
Published by MODERN PLASTICS, INC
122 EAST 42nd ST., NEW YORK 17, N. Y

"LETTER PERFECT"—

Custom Injection Moulding of Quality

For Custom Injection Moulding . . . try the Trio

ARMY E NAVY

Custom Injection wmp Moulders

WORCESTER MOULDED PLASTICS COMPANY

8 GRAFTON STREET WORCESTER 8, MASSACHUSETTS
17 EAST 42nd ST., NEW YORK 17, N. Y.